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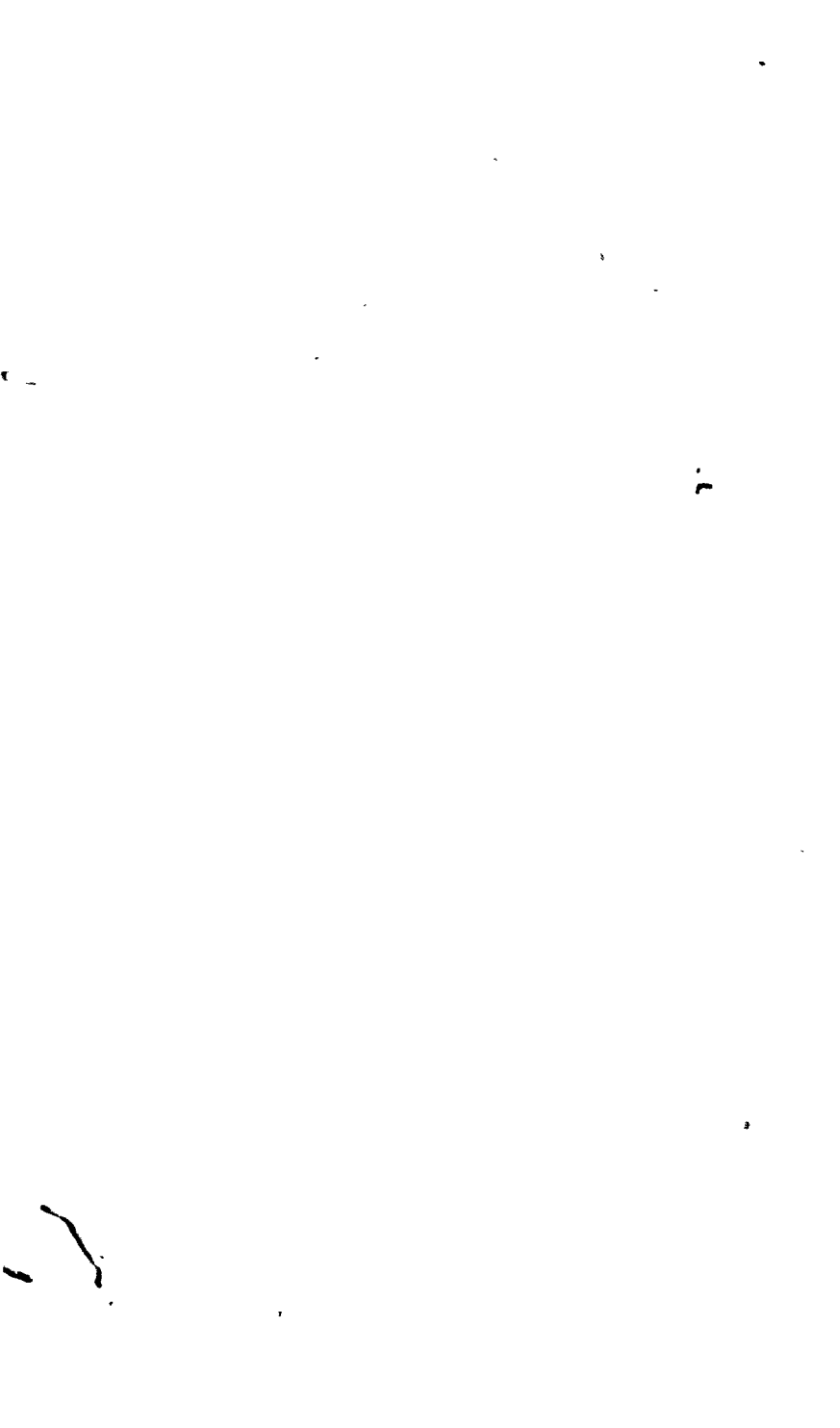
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PROCEEDINGS

OF THE

ROYAL GEOGRAPHICAL SOCIETY.



25285

VOL. XXII.

SESSION 1877-78.

Nos. I. to VI.

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OF
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[PUBLISHED JANUARY 10TH, 1878.]

SESSION 1877-8.

First Meeting, 12th November, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

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J. L. Clifford Smith, Esq.

ELECTIONS.—*John Bolton, Esq.*; *Edward Easton, Esq.*; *Rev. Joseph Mullens, D.D.*; *Josiah Mullens, Esq.*

DONATIONS TO LIBRARY, 26TH JUNE—12TH NOVEMBER, 1877.—*Neue Landesbeschreibung der zwey Hertzogthümer Schleswick und Holstein, durch Caspar Danckwerth und J. Meyer, 1852 (Dr. P. W. Forchhammer).* Two Albums containing Photographic Views of the Blue Mountain Scenery, New South Wales (*Eccleston Du Faur, Esq.*). Scientific results of the U. S. Arctic Expedition, Steamer *Polaris*, vol. i. Physical Observations, by E. Bessels; Washington, 1876 (*Author*). Narrative of the North Polar Expedition, U. S. ship *Polaris*, by Rear-Adm. C. H. Davis, U. S. N.; Washington, 1876 (*Admiral Rodgers, Superint. U. S. Naval Observatory, per Dr. Nourse*). *Le Mont Blanc*, par C. Durier; Paris, 1877 (*Author*). The Voyages of the Ambassadors sent by the Duke of Holstein to the Great Duke of Muscovy and the King of Persia, by Adam Olearius, translated by John Davies, 1662; and the Six Voyages of John Baptista Tavernier, made English by J. P., 1678 (*Major Alfred E. Wilkinson*). *La Végétation du Globe*, par A. Grisebach, traduit par P. de Tchihatchef, vol. ii., 2^{me} fascicule, completing the work (*M. de Tchihatchef*). Memorials of the Discovery and Early Settlement of the Bermudas, by J. H. Lefroy, vol. i. (*Messrs. Longmans*). Supplement to his General

Catalogue of Books, by B. Quaritch, 1877 (*Mr. Quaritch*). Catalogue of Scientific Papers, vol. vii. (1864-1873), 1877 (*The Royal Society*). Lehrbuch der alten Geographie, Erste Hälfte, Asien und Africa, von H. Kiepert; Berlin, 1877 (*Author*). Nova Zembla, 1596-1597: the Barents Relics, by J. K. J. de Jonge, translated by S. R. van Campen, 1877 (*Translator*). Notes sur le pays de Harrar, par Mohammed Moktar; Le Caire, 1877 (*The Khedivial Society of Geography*). Journal of the Expedition for the Exploration of the Fly river, by L. M. D'Albertis; Sydney, 1877 (*Dr. G. Bennett*). Essay on New South Wales, and Five Free-trade Essays, by G. H. Reid; Melbourne, 1877 (*Author*). Memoria de Guerra i Marinha, por el Ministro del Ramo en 1875, Santiago de Chile, 1875, and Anales de la Universidad de Chile, Noviembre, 1875 (*Dr. R. A. Philippi*). Arctic and Sub-arctic life, by J. Rae, 1877 (*Author*). On the distribution of the Brachiopoda in the Oolitic strata of Yorkshire, by W. H. Hudleston and J. F. Walker (*Authors*). Baedeker's Switzerland, 7th edn.; Leipsic, 1877 (*Editor*). Geological Survey of Canada, Report of progress for 1875-76; Montreal, 1877 (*A. R. C. Selwyn, Esq., Director of the Survey, on behalf of the Govt. of the Dominion*). Report on Surveys, &c., on the Canadian Pacific Railway, by S. Fleming; Ottawa, 1877 (*The Govt. of the Dominion*). Expéditions Suédoises de 1876 au Yenissei, par F. Schulthess; Upsal, 1877 (*Translator*). The Conversation Manual in English, Hindustani, Persian and Pashtû, by G. T. Plunkett, 1875 (*Author*). History of the Cape of Good Hope, by A. Wilmot & J. C. Chase; Cape Town, 1869 (*A. Wilmot, Esq.*). A refutation of the Report of the Scurvy Committee, by C. R. Markham, 2nd edn., 1877 (*Author*). Report on foreign missions to the General Assembly of the Free Church of Scotland; Edinburgh, 1877 (*The Committee*). Essai météorologique, par J. Pfund, Psychometrical observations taken at Fascher, Darfour, 1876, and Summary of letters and Reports of H. E. the Governor General, Pt. 1; Cairo, 1877 (*General Stone*). Atlas des mouvements supérieurs de l'atmosphère, par H. H. Hildebrandsson; Stockholm, 1877 (*Author*). Die Stammverwandschaft der meisten Sprachen der alten und australischen Welt, von D. E. D. Europæus; St. Petersburg, 1877 (*Author*). L'Afrique occidentale, Algérie, &c., par Paul Soleillet; Avignon, 1877 (*Author*). Report on the division of Oudtshoorn, by J. G. Gamble; Cape Town, 1877 (*Author*). A descriptive Catalogue of the Venezuelan Department at the Philadelphia Exhibition, by A. Ernst; Philadelphia, 1876 (*Author*). South African Diamond Fields and the Journey to the Mines, by W. J. Morton; New York, 1877 (*H. G. Bevington, Esq.*). South African Notes on Woman Slavery, &c., by J. H. Winter,

1877 (*Author*). A travers l'Afrique, par J. de Borchgrave ; Bruxelles, 1877 (*Author*). From Swatow to Canton, overland, by H. A. Giles ; Shanghai, 1877 (*Author*). Do Amazonas ao Oyapock, por L. da Gama e Silva ; Pará, 1877 (*Author*). Zehnjährige Mittelwerthe, 1866-75, für Dorpat, von K. Weihrach ; Dorpat, 1877 (*Author*). Letter on selection of terminus on the Pacific Coast for the proposed Canadian Pacific Railway, 1877 (*Anon.*). Report on the operations of the Sanitary Department for the four years ending 30 April, 1877, by K. M. Macleod ; Glasgow, 1877 (*Author*). Programme des travaux d'une Expédition polaire internationale, proposé par Le Comte Wilczek et Charles Weyprecht ; Vienne, 1877 (*Lieut. Weyprecht*). Canal Interocéanique, 1876-77, Rapport sur les Études de la Commission internationale, par N. B. Wyse ; Paris, 1877 (*Author*). Few words on the Native question, by E. Holub ; Kimberley, 1877 (*Author*). Meteorological Report, 1875, Colonial Museum and Geological Survey Department ; Wellington, 1877 (*Dr. J. Hector*). Die Schutzmittel der Pflanzen gegen Thiere, von Otto Kuntze ; Leipzig, 1877 (*Author*). La Perse et les Persans, par M. le Marquis de Croizier ; Paris, 1873 (*Author*). Catalogue of the North China Branch of the R. Asiatic Society, by H. Cordier ; Shanghai, 1872 (*H. G. Hollingworth, Esq.*). Amphiorama, ou la Vue du Monde, par F. W. C. Trafford ; Lausanne, 1877 (*Author*). Report on the Vizagapatam and Backergunge Cyclones of 1876, by J. Elliott, Calcutta, 1877 (*Author*). On Ocean Currents, Part iii., by J. Croll, 1874 (*Author*). Report to Congress from Committee on Naval affairs, on expedition to the Arctic Seas, 1877 (*The Committee*). Spedizione Geografica Italiana nell' Africa Equatoriale, Bollettino No. 5 ; Roma, 1876 (*G. Moore, Esq.*). Guides to Munich and Vienna, Parliamentary Return on correspondence relative to the Suez Canal, 1874, British Protectorate in Fiji, by W. McArthur, 1873, Treaty between Russia and Bokhara, 1869, and two tracts on Oriental Proverbs, by the Rev. J. Long, 1875 (*Rev. J. Long*). A Summer trip to the island of St. Michael, the Azores, by R. Swindells ; Manchester, 1877 (*Author*). Kreta, eine geographisch-historische Skizze, 1875, and Eine historische Skizze, 1876, München, von H. Strobl (*Author*). The high lands of the Cameroons and Ambas Bay, by H. A. Leveson, 1871 (*H. W. Bates, Esq.*). Imperial federation of Great Britain and her Colonies, by F. Young, 1876 (*Author*). A General Report on the Yusufzais, by H. W. Bellew ; Lahore, 1876 (*Capt. J. G. Cockburn*). Erupcion ofitica del Ayuntamiento de Molledo, por S. Calderon y Arana & F. Quiroga y Rodriguez ; Madrid, 1877 (*Authors*). Thoughts upon the present and future of South Africa, and Central and Eastern

Africa, by Donald Currie, 1877 (*Author*). Le Zénaga des tribes Sénégalaises, par L. Faidherbe; Paris, 1877 (*Author*). The Mercantile Directory of the World, 1877 (*Mr. J. Wilson*). Landwirthschaft (and 7 other pamphlets) von Albert Orth, Wien (*Author*). Magnetische Inclinationen in Tiflis, von H. Kiefer; Tiflis, 1877 (*Author*). Himalayan Origin of the Magyar and Ugrian, by Hyde Clarke, 1877 (*Author*). African Colonisation, by J. Orcutt, New York (*Author*). On geographical discoveries in Asiatic Russia, 1577-1877, in Russian, by M. Veniukoff (*Author*). Ueber die centralasiatischen Seidenstrassen bis zum 2 Jahrhundert n. Chr., von F. von Richthofen; Berlin, 1877 (*Author*). Letters from Daeka on the Zambesi, by H. Bond, 1874; Report on the province of Larut in Perak, by T. C. S. Speedy, Singapore, 1875; Introduction and Succession of Vertebrate life in America, by O. C. Marsh, New Haven, 1877; and Uriage et ses environs, par A. M. Ladichère, 2^{me} edn. (*The Librarian, R.G.S.*). Notes on the Colony of Victoria, by H. H. Hayter; Melbourne, 1876 (*Author*). Mineral Statistics of Victoria for 1876, Reports of Mining Surveyors and Registrars, to 30 June, 1877; Report of Chief Inspector of Mines for 1876; Statistical Register for 1876, Pts. I.-VI.; Agricultural Statistics of Victoria, 1876-77; and Geological Survey, Report of Progress, No. IV., 1877 (*The Victorian Government*). Nivellement de précision de la Suisse, 6^{me} livrⁿ, par A. Hirsch et E. Plantamour, Genève, 1877; Survey of the mouth of the Indus, by A. W. Stiffe, 1877 (*H.M. Secretary of State for Foreign Affairs*). New Guinea Exploration, extract from log-book of the *Nera* by L. M. D'Albertis, Sydney, 1876; Report of W. Coates Palgrave, Esq., Special Commissioner to the tribes north of the Orange River, of his mission to Damaraland and Great Namaqualand in 1876, Cape Town, 1877 (*H.M. Secretary of State for the Colonies*). Mysore and Coorg, a Gazetteer compiled for the Government of India, by L. Rice, 2 vols., Bangalore, 1876; Selections from the Records of the Madras Government, Nos. LII. and LIX.; Selections from the Records of the Bombay Government, new series, Nos. CXXXIX. and CXLVIII.; Statements exhibiting the Moral and Material progress of India, 1873-74, 1874-75, and 1875-76; and General Report of the Trigonometrical Survey of India, 1874-75 (*H.M. Secretary of State for India*). Memoirs of the Geological Survey of India, fo., Ser. II., 2, Jurassic Flora of the Rajmahal group, by O. Feistmantel; Ditto, 8vo., vol. xiii., pts. 1 and 2 (*Dr. Medlicott, by direction of the Governor-General of India*). Quarterly Weather Report of the Meteorological Office, Part IV., Oct.-Dec. 1874 (*The Meteorological Committee*). Report of Committee of Coun-

cil on Education, England and Wales, with Appendix, pts. I.-V., 1876-77; Ditto, Scotland, with Appendix, 1876-77; and Fourth Annual Report of the Board of Education for Scotland to Lords of Privy Council in Scotland, 1877 (*The Committee of Council on Education*). The Mediterranean Pilot, vols. i. and ii., 1873 and 1877; Sailing directions for the Dardanelles, Sea of Marmara, and The Bosphorus, 2nd edn., 1877; and General Instructions for the Hydrographic Surveyors of the Admiralty, 1877 (*The Lords Commissioners of the Admiralty*). (No. 38) Coasts and Ports of the Gulf of Lyons and Gulf of Genoa, by H. H. Gorringer; Report on telegraphic determination of differences of longitude in the West Indies and Central America, by F. M. Green; Remarks on the coasts of Lower California and Mexico, by G. Dewey, 1874; Observing list of Stars for determination of time in Southern hemisphere; (No. 48) West Coast of Africa, Part 3 and (No. 63) Navigation of the Caribbean Sea, vol. i. (*The U. S. Hydrographic Office, per Commodore R. H. Wyman*). Washington observations for 1871, appendix iii., Catalogue of Stars, 1845-1871, by M. Yarnall, Washington, 1873; Ditto for 1868, appendix i., Catalogue of 1963 stars reduced to 1850; Washington, 1870 (*The U. S. Naval Observatory, per Commodore B. F. Sands*). The Practical use of Meteorological Reports and Weather-maps; Washington, 1871 (*The U. S. War Department*). Report of Director of New York Meteorological Observatory for 1876; New York, 1877 (*D. Draper, Director*). Bulletin of the U. S. Geological and Geographical Survey of the Territories, iii., Nos. 1-4; Catalogue of publications, 2nd edn.; Bulletin of the U. S. Entomological Commission, Nos. 1 and 2; Sketch of the origin and progress of the U. S. Geological and Geographical Survey of the Territories; Explorations made in 1876; Preliminary Report of the U. S. Geological Survey of Wyoming, 1871; Miscellaneous publications, No. 7; Ethnography and Philology of the Hidatsa Indians, by W. Matthews, 1877; No. 8, Fur-bearing animals, by E. Coues, 1877 (*Dr. F. V. Hayden*). Annual Report on Geographical Surveys West of the 100th Meridian, for 1876, with accompanying Topographical Atlas sheets (*Lieut. G. M. Wheeler*). U. S. Geographical Exploration of the 40th Parallel, vol. vi., Microscopical Petrography, by F. Zinkel; Washington, 1877 (*Clarence King, Geologist-in-charge*). Annales Hydrographiques, Nos. 567 and 571; and Publications of the Dépôt des Cartes et Plans de la Marine, No. 563, Mer Méditerranée, par J. S. Bayot; No. 564, Mer des Antilles et Golfe du Mexique, 1^{ère} ptie., par A. Sallot des Noyers; Nos. 565, 566, & 568, Suppléments aux Instructions Nos. 352, 353, 468, & 469; No. 569, Recherches Météorologiques, No. 1, par M. Toynbee; No. 570,

Annuaire des Marées des Côtes de France pour l'an 1878, par M. Gaussin et M. Hatt; No. 573, Supplément à l'Instruction No. 361 (*The French Minister of Marine*). Statistique générale de l'Algérie, Années 1873 à 1875; Paris, 1877 (*The French Minister for the Colonies*). Recueil de Poèmes Historiques en Grec vulgaire relatifs à la Turquie, par E. Legrand; Paris, 1877 (*The French Minister of Public Instruction, per H. M. Foreign Office*). S. W. Silver & Co's. Handbook to the Transvaal, 1877 (*S. W. Silver, Esq.*). Juridical Monographs and Researches, vol. iv. (in Russian), by A. Lubafsky; St. Petersburg (*Author*). Déli et les Colons-explorateurs français, par B. de St. Pol-Lias; Paris, 1877 (*Author*). Two reports on the Surveys of New Zealand; Wellington, 1877 (*J. T. Thomson, Esq., Surveyor-General*). The continuation of Reclus' Nouvelle Géographie Universelle, livraisons 131-152; and the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM 25TH JUNE TO 12TH NOVEMBER, 1877.—130 sheets of the Government Surveys of India (*H. M. Secretary of State for India, through the India Office*). 47 sheets of Admiralty Charts (*Hydrographic Office*). Map of the Seat of War in Europe—4 sheets $\frac{1}{500000}$. Map of probable concentration, and lines of operation in the event of an occupation of Asia Minor by Russia, Map of Roumelia and Bulgaria—6 sheets $\frac{1}{422000}$. Topographical Atlas of Jutland—13 sheets $\frac{1}{40000}$ (*Danish General Staff, through the Danish Minister*). Sketch Map of New Zealand in two sheets, showing Roads, Railways, and County Boundaries, and Plan of Bluff Harbor (*James Harvey*). Telegraph Map of the World (*Telegraph Maintenance and Construction Co.*). 28 sheets of French Charts (*Dépôt de la Marine*). 107 Photographs taken during the Arctic Expedition, 1875-76 (*Admiralty, through the Secretary of the Admiralty*). 12 sheets United States Charts (*Commodore Wyman, U.S.N.*). Atlas of Index Charts (*Hydrographic Office*). 8 sheets of Marine Survey of India Charts (*Marine Survey Department, through Captain A. Dundas Taylor, I.N.*). Sheets 2 and 3 of Stanford's large-scale map of the Seat of War in Europe, and Stanford's large-scale map of the Seat of War in Asia (*Edward Stanford*). 8 sheets, MS. tracings by J. B. Minchin of Map del Beni-y-Gran Chaco, and Mapa Nuevo de la Republica Boliviana (*Commander G. C. Musters, R.N.*). Fly River, by S. M. D'Albertis (*S. M. D'Albertis*). South African Republic-Transvaal, by F. Jeppe, F.R.G.S. (*E. Weller*). Victoria, showing portions of the adjacent Colonies of New South Wales, South Australia, and Tasmania, 2 sheets, by Surveyor-General, Melbourne, 1876 (*Agent-General for Victoria*). Schwein-

furth's & Güssfeldt's Reise in der Arabischen Wüste, 1876, Der Mar Antonius aufgenommen von Dr. Paul-Güssfeldt, 1876. Deutschland's Wassertrassen von Dr. Th. H. Schunke. Aufnahme des Untern Congo und seiner Delta-Verzweigungen, von Midlycott & Flood, 1875. Originalkarte von Donau-Bulgarien; dem Balkan und Sud-Ost Serbien, nach seiner Reise-Aufnahmen, von F. Kanitz $\frac{1}{825000}$. Nivellements der Trigonometrischen Abtheilung der Königlich Preussischen Landes-Aufnahme. Specialkarte vom mittleren Ost-Sudan, bearbeitet von K. Zoeppritz. Der Ostliche Theil von Nord-Amerika zur Übersicht der Eisenbahnen und Wasserstrassen, von A. Petermann $\frac{1}{3700000}$. Russland's Eisenbahnen und Wasserstrassen, von A. Petermann. Deutsche und Romanen in Süd-Tirol und Venetien, nach C. Schneller, von A. Petermann. Originalkarte des Hauptgebietes von Costarica zur Übersicht der Aufnahmen von W. M. Gabb, Collins & Martinez, von A. Petermann. Originalkarte von Sawrieff's Aufnahme des Bin-Cöl-Dagh, 1874 (*Dr. A. Petermann*). Massowah to Keren, MS. tracing (*Col. Gordon, through Lieut. C. M. Watson, R.E.*). Carta Geográfico-Topografica de la Isla de Cuba, 1835 $\frac{1}{400000}$ (*Lord John Hay*). Military Map of the Indian Territory, Department of Missouri, by First Lieut. E. H. Ruffner, U.S.A. (*S. E. Col. H. G. Prout*). Atlas, in Chinese Character, of China, Manchuria, Mongolia, Tibet, &c., in 26 sheets, published at Woo-Chung about 1862 (*H. Geo. Hollingworth*). Der Meerbusen von Korinth oder Lepanto (*Anon*). Keith Johnston's Royal Atlas, 1877 (*W. & A. K. Johnston*). Map of the Russian Government of Kaluga (*A. Lubafsky*). Map of the Course of the River Livingstone (Congo-Lualaba), drawn from the original by Edwin Arnold (*Edwin Arnold*).

The PRESIDENT opened the Session with the following Address:—

ACCORDING to the custom followed by my predecessors in this chair, which by your favour I have been chosen to occupy for another year, I proceed to offer you, as a preface on the opening of our new Session, a brief review of Geographical progress since we last met. But first I have to congratulate you on the continuance of the privilege which has been granted us by the Senate of the London University, of holding our meetings in this theatre. It is hoped that the new Regulations, which were the result of the deliberations of the Joint Committee on Evening Meetings last Session, and adopted at the Annual General Meeting, may answer the purpose contemplated, and secure all Fellows who may wish to attend, with the friends they personally introduce, from inconveniences complained of on several occasions, more

especially when Meetings of exceptional interest took place. I am not sanguine, however, in my anticipation that any regulations can entirely meet all the requirements of Resident and Non-Resident Fellows. I have little hope indeed that any rules, however carefully framed, will effect this object on occasions of extraordinary interest, for the simple reason that if a large proportion of the Fellows should ever desire to be present, and to exercise their privilege of introducing visitors, no place of meeting of smaller dimensions than the Albert Hall could afford the necessary accommodation; and failing this, disappointment and dissatisfaction would of course be unavoidable. The Council, as the Society must feel assured, can in this matter have no other desire, than to meet, as far as possible, the convenience and the wishes of the Members collectively. With this view, the Council readily assented to the proposal made last Session at a Special Meeting to appoint a Joint Committee to consider all the difficulties; and in the same spirit they submitted to the Anniversary General Meeting, the new rules, as framed by that Committee. Although objections have been made by Members in the country to some of the provisions as giving an undue advantage to Resident Fellows, and curtailing privileges previously enjoyed by both, the Council recommend that a fair trial should be given to the newly adopted rules; bearing in mind the insuperable nature of the difficulties to be encountered, where the convenience of from three to four thousand Members and their friends as visitors have to be consulted.

In pursuance of the plan adopted during the last Session for giving a more strictly scientific direction to the range of the Society's work and influence, arrangements have been made for the delivery of three lectures on 'Physical Geography,' in its more scientific aspects, in the course of the present Session; the success attending the first series having been sufficiently encouraging to justify a continuance during another year. The first will be delivered by Professor Duncan, 'On the Formation of the Main Land-Masses of the Earth;' the second by Capt. F. J. Evans (the distinguished Hydrographer to the Admiralty), 'On Terrestrial Magnetism,' and the third by Mr. Thiselton Dyer, 'On Plant Distribution as a Field of Geographical Research.'

Events of great Geographical interest have occurred during the vacation, in connection with Central Africa, both as regards Explorations accomplished and measures taken for further efforts. But before giving you a sketch of what has been accomplished in this important field, it is my duty, in accordance with previous usage, to take a passing glance at the proceedings of another body

in close connection with our own Society, which always holds its Meetings during the annual vacation: I mean the Geographical Section of the "British Association for the Advancement of Science," which met this year at Plymouth in the middle of August. Under the presidency of that distinguished Geographer, Admiral Sir Erasmus Ommanney, who held for so many years a seat on your Council, the Geographical Section maintained the popular position which it has always held, and its members had the privilege of listening, in the Presidential Address, to an able summary of the progress of Geographical Science and Discovery during the thirty-six years which had elapsed since the British Association last met at Plymouth. Amongst other subjects which came before the Section was a Paper by Commander Cameron on the proposed permanent Stations in Central Africa as bases for future Exploration, in which the gallant officer applied the results of his great experience to the consideration of this important portion of the scheme of His Majesty the King of the Belgians. The long and animated discussion which followed the reading of this Paper, and the large audience which was assembled to hear it, tend to prove that the subject of African Exploration and eventual civilisation has a permanent hold upon the public mind. Among the Papers read during the Association week there were many which contained a large amount of new and interesting geographical information. I may mention more particularly Dr. O. Finsch's narrative of the German Exploring Expedition, which in 1876 traversed the isthmus between the River Obi and Kara Bay, in the Arctic Seas; Major Godwin-Austen on the connection of the Tsanpo River of Tibet with the Brahmaputra; and Mr. Floyer on the country of Bashakurd.

In other fields there is little at this moment requiring remark. At the Meeting of the Russian Geographical Society of the 5th of October, a Report was read from M. Prejevalsky of his Expedition to Lob-Nor. After resting from his first arduous journey at Kuldja, this intrepid traveller commenced the second part of his journey, more dangerous and difficult even than his previous explorations in those inhospitable regions, the object of which was to penetrate into Tibet. I have been favoured by Mr. Delmar Morgan with some notes of this Report, translated from the Russian, which are sufficiently interesting to deserve a place in our 'Proceedings,' where they will be found;* together with some news received from Potaninji's Expedition, in the direction of Hami and Uliassutai, across the Altai Nouron Mountains

* *Vide* p. 51, *infra*.

and the Gobi Desert, which latter occupied only two days in the passage.

With regard to Africa, the termination of Mr. Stanley's most arduous and successful journey across the Continent, with the discovery of the true course of the Congo, is the great Geographical event of the day, and demands special notice. We have only at present a brief statement of the results of Mr. Stanley's explorations contained in a telegraphic despatch from Emboma on the Congo, of August 10th, and in his subsequent letter, which appeared in the 'Daily Telegraph' of the 11th of October, from Cabenda (or Kabinda), on the coast, now supplemented by another letter which has just been published. It appears he left Nyangwe in Manyema, where Livingstone left off, on November 5th, 1876, travelling overland through Ulegga. Unable to make progress through the dense forests, he crossed the Lualaba, and continued his journey along the left bank through North-east Ukusu.

It is too early yet to appreciate at their just value the scientific and geographical data which may have been obtained by Mr. Stanley in tracing the whole course of the Lualaba-Congo from Nyangwe in the centre of the continent to the Atlantic. We must wait for further information and more ample details. But, in the meantime, there can be no doubt that he has succeeded in solving the greatest of the remaining geographical problems. He has indeed decided more than one of the doubtful points of African Geography, by his circumnavigation of the Victoria Nyanza and Tanganyika, completing, as he himself claims, the discoveries of Burton, Speke, and Grant in many important particulars.

The information thus obtained must have an important bearing both on future exploration and the development of commerce along the course of the Congo, although Mr. Stanley speaks of numerous cataracts both north and south of the Equator. A series of cataracts at two extremities constitute serious difficulties to be overcome, in any effort to establish a trade along the 1400 or 2000 miles of uninterrupted navigation on the main river and its great affluents of which he speaks. They will involve not only interruptions and portages at the five great cataracts north and south of the equator, before the commencement of the continuous 1400 miles course, but the same must take place where the river plunges by a succession of some thirty rapids and cataracts down to the Atlantic shore. There must be a possibility of establishing practicable roads for portages along the interrupted line of navigation—and in some parts it would seem despite the opposition of hostile and savage tribes—or nothing can be done. Still, whatever may be the difficulties arising from an unhealthy climate, native hostility,

and cataracts, it is impossible to doubt that Mr. Stanley's last achievement in African Geography will form a new era by laying open to commercial enterprise a vast, and practically unlimited market for the barter of tropical produce and manufactured goods.

Such is the opinion formed by Mr. Stanley himself, who has had better opportunities of forming a judgment than anyone else, both as to the impediments and the facilities to be found. Speaking of these he says that "large as the number of cataracts and rapids mentioned above may be, we have discovered that the great highway of commerce to broad Africa is the Congo."

Turning now from this brilliant achievement in African Exploration, to the efforts making in the same field to enlarge our geographical knowledge, I must recall to your memory the account I gave you in my Opening Address of last year, and in the succeeding Anniversary Address in May last, of the objects of the International Conference, which met at Brussels in September of last year, at the invitation of the King of the Belgians.

The International Commission established by that Congress for the exploration and civilisation of Africa, with an invitation to all nations to form national committees of co-operation, has led to a very general movement throughout Europe for the promotion of these objects. National Committees or Associations have been formed, and considerable sums have been subscribed, in nearly every country, from the Baltic to the Mediterranean. The International Commission met this year again, on the invitation of the King of the Belgians, at Brussels, on the 20th and 21st of June, and was attended by delegates from the several National Committees. Great Britain and Russia were exceptions, but from different causes. As regards this country, the circular of the Council, constituting the African Exploration Fund Committee, must have placed all the members of this Society in possession of the insurmountable obstacles to any affiliation, on our part, to the International Commission.

At a public meeting held at the Mansion House on the 19th of July last, the Lord Mayor in the chair, I deemed it right fully to explain the position of the Geographical Society, and I had previously with the same view called attention to the main facts in a letter published in the 'Times.' In this I stated more especially, that the part which Great Britain is to take in this great movement cannot be a matter of indifference to the nation that has hitherto held a leading position in the exploration of Africa,—whose travellers have discovered in the present generation the sources of the Nile, and done more than all other nationalities combined

within the last twenty years, to make known to the world the interior of Central Africa and the great Lake region, as the sketch-map accompanying the circular of the African Exploration Fund Committee plainly shows. The commercial and colonial interests, and the territorial possessions in Africa of this country are larger than those of any other European Power, while the suppression of the slave-trade and the advancement of missionary labours have been objects of national concern for more than half a century. It was the natural desire, therefore, of the British members, geographers, and others invited to the Brussels Conference, to take part in the International Commission, and to co-operate cordially with it in furtherance of the excellent purposes set forth in its programme, notwithstanding some obvious difficulties touching international questions and territorial rights. But the Geographical Society could not by its constitution enter upon any field of operations other than that of exploration. Commercial enterprise, suppression of the slave traffic, and Missionary or other civilising efforts, will each and all profit by any progress in systematic and continuous geographical exploration. But they are objects out of the province of a Geographical Society, and must be pursued by independent agencies.

Under these circumstances it has been a source of great gratification to myself personally, and I am sure it will be to the Society, to learn that a first Expedition under the direction of the International Commission of Brussels left Southampton on the 18th of last month for Zanzibar. It is composed of four Europeans, viz., M. Crespel, chief; M. Cambier, astronomer and geographer; M. Maes, naturalist; M. Marno, explorer. The chief object of this important undertaking, I am informed, is the formation of a station at, or beyond Lake Tanganyika, with depôts at Zanzibar and in Unyamwesi. The African Exploration Committee of your Council, which had previously made a grant of 250*l.* to the Executive Commission at Brussels, has further shown its active sympathy with this undertaking by officially recommending the Expedition to the Consul-General at Zanzibar, and through him to His Highness the Sultan. It has also addressed the London and the Church Missionary Societies, with a view to obtaining a welcome for the Expedition on the part of the agents of these societies in Central Africa. I am happy to add that the Commission at Brussels has already some 300,000 francs of capital, contributed chiefly in Belgium, and an income of 75,000 francs—speedily to be increased to 100,000—so enthusiastically and generally has the appeal of the King been responded to by his own subjects.

With reference to the action of other countries, France has established a National Committee to co-operate with Brussels, under the presidency of M. F. de Lesseps. I need hardly remind you that the French have independently, for several years past, made persevering attempts to penetrate the interior of Africa from the side of their settlement of the Gaboon, by ascending the Ogowé River, a tributary of the Fernan Vaz, which has been long rumoured to take its rise from a lake in the far interior. The private Expedition of Messrs. de Compiègne and Marche, in 1873-4, has so far been the most successful of these enterprises. But it failed in reaching the head-waters of this important river, owing to the hostility of the cannibal Osyeba tribe on its banks. A larger and better-equipped Expedition left France in 1875, under Lieut. de Brazza, M. Marche, and Dr. Bellay. At the outset M. de Brazza believed he should be able to reach Lake Tanganyika in three years. Although accompanied by an armed force of natives from Senegal, he has been foiled by the same Osyeba tribe, and by sickness and failure of provisions. According to the latest news, he has been obliged to descend to the coast and refit with a view to another attempt. It is stated that a grant in aid of De Brazza's Expedition has been made by the International Commission of Brussels. The *Moniteur de la Flotte*, in announcing the latest news received of this Expedition, states that the letters received were written at Doumé, described as a miserable village on the banks of the Ogowé, at the extreme limit of the Adouma country, and situated 56 min. south of the equator and 11 deg. to the eastward of Paris. Most of the party had suffered from fever and sickness; but, somewhat better food having been obtained, nearly all had recovered before the letters were despatched. From Doumé it was intended to continue the journey eastward; but great difficulty was experienced in obtaining the services of natives to act as carriers. The leader reported that slavery flourishes on the banks of the Ogowé, and that the natives are ready to sell their children and nearest relatives to the slave-dealers.

On the geography of the district, Lieutenant de Brazza remarks that he has already passed through several tribes, the districts inhabited by whom are marked on Dr. Petermann's maps as being much farther inland than the point he has reached; and, further, that the River Lilumbay, which is shown as an affluent of the Congo, really flows into the Ogowé. Another Expedition has within the last few days been announced as on the point of proceeding from France, but its exact destination has not reached me.

The German National Committee has been merged into a

"German African Society," distinct from the "German Society for the Exploration of Equatorial Africa," under which, for several years, a series of explorations of much value in a strictly scientific point of view, conducted by Dr. Güssfeldt and others, has been carried on, in the coast regions immediately north of the Congo. The German African Society will devote its funds chiefly to the encouragement of German explorations from the *west* coast, and contribute only a portion, varying according to circumstances, to the International Commission at Brussels. According to the most recent intelligence, the "African Society" is about to send out its first expedition, under Herr Schütte, an engineer, well qualified as a scientific topographer, with a view to penetrate the interior from the west coast, taking Angola for a basis.

We hear nothing further of the National Committee in Austria, constituted under the presidency of the Crown Prince, since the announcement that it had contributed 5000 francs to the International Commission at Brussels. In Hungary a separate National Committee has been formed, which has also forwarded the sum of 3000 francs to the Central Commission in Belgium. In Italy the Italian National Committee has held important meetings under the presidency of the Crown Prince Humbert. It has resolved at present to devote all its means to the support of the Expedition of Marquis Antinori, which is now engaged in the arduous task of endeavouring to penetrate the unknown region lying between Shoa and the Victoria Nyanza.

Marquis Antinori's Expedition left Italy, April, 1876; but unforeseen expenses and losses on their disembarkation at Zeila, and on their route thence to the capital of Shoa, hampered the progress of the party, and it was then found necessary to despatch one of its members (Capt. Martini) to Italy, to obtain further supplies. The funds for the support of the Expedition were supplied by private subscription, and by grants made by the Minister of Public Instruction and various scientific bodies, to the extent of 120,000 lire. Out of the unexpended balance of this, Captain Martini was re-equipped, and he returned to Zeila, in company of Signor Cecchi, early in the present year. The latest accounts state that Signors Martini and Cecchi had rejoined their chief safely in June last, at Tull-haré, in the interior. It is hoped now that there will be no further delays, and that this grand Expedition will be able to push forward for Victoria Nyanza.*

* Since this was in the press, the melancholy intelligence has reached Europe of the death of this distinguished traveller.

Excited apparently by the narratives and revelations of Commander Cameron and Lieut. E. D. Young, the Portuguese resolved last year to make a tardy effort to do something towards the scientific exploration of the unknown regions adjoining their African possessions. Not only the Government, but the nation, took part in the movement, and long and excited debates on the subject were held in the Chamber of Deputies at Lisbon—chiefly in reference to the alleged continuance of a slave-trade in the African possessions of Portugal, both on the East and West Coast. Of the fact of such traffic still existing, the correspondence recently published in the Blue Book on the Slave-trade laid before Parliament last Session leaves no doubt.

The Government had established a Geographical Committee in connection with the Department of Marine, distinct from the Geographical Society of Lisbon, which was founded independently by public effort. An expedition was decided on, and Government made a grant of 20,000*l.* towards the expenses. The first Expedition left Europe in June last for Loanda. It consisted of Senhor Serpa Pinto, Senhor H. Capello, and Lieutenant R. Ivens, and was expected to leave Loanda for the interior in July. Of the various routes proposed for this Expedition, the more southerly one, comprising the ascent of the Cassabi, and the examination of the relations of its basin with those of the Quanza, the Cunene, and the Zambesi, terminating with a journey to the East Coast, was that finally chosen before the Expedition left Europe. With regard to the other principal route which was discussed, viz., the exploration of the Congo from above the Yellala Falls, the Portuguese have been forestalled by the recent exploit of Mr. Stanley; and his important discoveries may lead to a modification of their plans.

The movement above described, and extending throughout Europe, has not been limited to Geographers or to Governments. The various Missionary Societies in Great Britain have manifested great activity, as the following notices will sufficiently show.

The Church Missionary Society has the intention of establishing a Mission Station at the capital of King Rumanika of Karagwe, west of Victoria Nyanza, and the *personnel* of the Missionary Expedition reached Zanzibar early in 1876. Their first operations were the exploration of the Rivers Wami and Kingani, with the view of ascertaining whether the interior could be reached by boat-navigation up those streams. Having convinced themselves that they were useless for the purpose, the mission-party commenced their march by land in four divisions. The

first division started on the 14th of July, 1876, under Mr. T. O'Neill and Mr. G. J. Clark, and arrived at Mpwapwa August 24th. The second, under the Rev. C. T. Wilson and Mr. W. Robertson, started July 29th. The third, under Mr. Mackay and Mr. H. Hartnell, started at the end of August. The fourth, under Lieutenant Shergold Smith, R.N., and Dr. J. Smith, started September 14th. Two parties left Mpwapwa for the Lake in October; one consisting of the Rev. C. T. Wilson and Mr. O'Neill, the other of Lieutenant Smith, Dr. J. Smith, and Mr. Mackay. Mr. Mackay's health failed on the way, and he was obliged to return to Zanzibar, but has since been usefully occupied in completing the waggon-road between Saadani and Mpwapwa. The other members of the party remained at Mpwapwa, where they have established a permanent station. The Rev. C. T. Wilson and Mr. O'Neill reached the southern shore of the Victoria Nyanza on January 29th, 1877; they have since launched their boat on the Lake, visited Ukerewe Island, and purchased a dhow of an Arab trader for their voyage across to Karagwe and Uganda.

The Church Missionary Society have a separate Mission also at Frere Town or Rabai, near Mombasa. It was from here that their missionaries Erhardt, Krapf and Rebmann, twenty-five years ago, made their memorable excursions into the interior, which gave the start to all that has since been accomplished in geographical discovery from the Eastern side of Africa.

The Niger Mission of the same wealthy and active society, under Bishop Crowther, is also important, especially in connection with the despatch of a steam-boat to enable him to navigate and explore the upper waters of the Benue, the principal tributary of that river.

Not less inferior in activity and success is the Universities Central African Mission, which has a station at Magila, in the picturesque region of Usambara, "the Switzerland of East Africa," as it has been termed, and which, under the initiation of Bishop Steere, has established a centre of useful work further south on the River Rovuma. At the time Mr. E. D. Young was launching his steamer, *Ilala*, on Lake Nyassa, Bishop Steere made an adventurous journey towards the shores of that Lake from the Rovuma, penetrating as far as the residence of the powerful chief M'taka, with whom friendly relations now seem likely to be established.

The London Missionary Society is engaged in establishing a Mission-station at or near Ujiji on Lake Tanganyika. The Rev. Roger Price is the chief, and Mr. Hore the surveyor. Mr. Hore left England for Zanzibar with a number of carts, drays, &c., in

April 1877. The Rev. Roger Price had previously departed, *viâ* the Cape, to obtain bullocks for the drays; and the whole of the party is now making good progress with their caravan towards the interior.

Both these Societies are largely and liberally supported, and the funds at their disposal are fortunately such as to enable them to take the most effective means to insure the success of their operations, in which we must always take a deep interest.

The Free Methodist Churches Missionary Society has also a station at Ribé, near Mombasa. Two members of the Mission have distinguished themselves by geographical exploration, *viz.* the Rev. C. New (whose premature death we all deplored) and the Rev. Thomas Wakefield.

The Free Church of Scotland Nyassa Mission started with a subscription of about 10,000*l.* The additional subscription for the year 1866-67 is 2200*l.* A leading feature of the Free Church Mission is the teaching of *handicrafts* to the natives. The members of the Mission are carefully chosen for their practical knowledge of trades. Thus there is a missionary blacksmith, carpenter, builder, and so forth. Mr. E. D. Young, R.N., took out the first mission party in May, 1875, and having thoroughly accomplished his task, and launched a steamer, in which, having circumnavigated the lake, and done excellent service in rectifying mistakes as to its extent, he returned to England. Meantime Dr. Stewart, with a reinforcement, joined the station October 1876, and took Mr. Young's place as superintendent. The station is Livingstonia, at the southern end of the lake. The number of missionaries there stationed is ten, besides native teachers from the Cape of Good Hope.

According to the latest accounts, the settlement was quietly progressing, but one of the principal members, Dr. Black, had died. Nothing in the history of exploration undertaken in the missionary spirit in these regions has been more encouraging than the course of willing native porters who flocked at the call of the missionaries to the foot of the cataracts which leap down, as Mr. Young describes, "a staircase of rocks and boulders" 1800 feet in the course of some 40 miles, and the joy with which the arrival of the party was greeted by the natives. The graves in this vicinity of Bishop Mackenzie, Mr. Scudamore, Mr. Dickinson, and Mr. Thornton, who gave their lives to this truly Christian work, were silent witnesses of the good they had effected, and such cheerful aid was the best proof that they had not been spent in vain. Thanks to such labourers in the field, the transport of

the steamer after it was taken to pieces offered no difficulty. In ten days, Lieut. Young reports, he was enabled to see "her sections, boilers, machinery and stores safely conveyed above the falls; to transport all our goods and baggage, and that at a very small cost, and without the loss of a single article of any sort, either by accident or theft, though we employed 800 men."* We need such a cheering picture, as a contrast to the dismal narrative of continuous conflict with the savages along the course of the Congo, of which we have yet but a slight though graphic sketch from the pen of Mr. Stanley.

The Established Church of Scotland, partly aided by the Free Church party, have founded a small station, called Blantyre, near Lake Nyassa, two days' journey east of the Murchison Falls.

The French Société de St. Esprit also has a Mission established at Bagamoyo, on the East Coast. In 1871, when Stanley arrived on his first expedition in search of Livingstone, he found there ten Padres, and a like number of Sisters of Mercy. He was most hospitably received, and reported that not only had they founded a Mission, constituting a village of sixteen houses, some solidly built, but schools, at which 200 boys and girls were under tuition, while the influence of the Mission was considerable, and eminently beneficial to the surrounding native population.

In addition to all these workers in the Missionary field who are aiding Geographical Exploration, are many travellers who may not lay claim to the title of Geographers, but from whom useful information is often derived in the field of African Exploration. The German Geographical Society of Berlin held a meeting a few months ago to hear the account of the travels of two successful African explorers of this character who had just returned home—Dr. Lenz, a Geologist, and Dr. Pogge. The latter had made a most remarkable journey, and one which will place him high in the list of African travellers. He had succeeded in penetrating from St. Paul de Loanda to the capital of the renowned African potentate Muata Yanvo (or Yambo), a remote district which had hitherto never been reached by any explorer, and even by very few coloured Angola traders. The capital, Musumbé, lies to the north of Kabebe, the seat of government of the preceding monarch, and many days' journey to the west and north of Cameron's line of march. Dr. Pogge travelled for pleasure as a hunter of the larger African game, and not as a

* See Lieut. Young's Paper, 'Geographical Proceedings,' No. IV., July 23rd, 1877.

scientific explorer; but some of the information he obtained is of high interest, particularly as to the healthiness and beauty of the interior plateau.

There are, in fact, constantly, in addition to regularly organised explorations, private expeditions on foot of various nationalities, and of which very little is heard, unless they accomplish something important, as in the above case of Drs. Lenz and Pogge. Thus there is Mr. A. Craven now engaged on a Natural History mission to Mpwapwa and beyond, to whom the African Exploration Fund has made a grant in aid of 100*l.* to be paid on his arrival at the scene of his work.

In reference to the routes suggested for exploration by the African Exploration Fund Committee in their circular, it may be stated that Nos. 3 and 4 are about to be traversed by H.M.'s Consul Elton, and by the end of this year something may be known of the progress made. And another party are on their way already to explore the land between the north end of Lake Nyassa and the East Coast, and most likely Mr. Stewart and his cousin, Mr. James Stewart, are now engaged in the endeavour to cross from Lake Nyassa to Tanganyika, forming No. 4 of the sketch-routes in the circular.

In order to complete this brief summary of active work now in progress, I may mention that the most recent information received in this country from Dr. Kirk, H.M.'s Consul-General at Zanzibar, is of a most encouraging character. He writes under date August 22nd, referring to the various exploring and mission parties now engaged in opening up the Zanzibar dominions and the interior :—

“To the south, the station of the Central African Mission at Msasi on the Rovuma, formed as an intermediate post for the purpose of gradually restoring the freed slaves from the Nyassa district to their country, is progressing favourably, and the Rev. Chauncey Maples had safely arrived with his party to augment the strength of that community. One of the party had visited M'taka, an influential chief and slave-trader near the lake, whom Bishop Steere had found willing to encourage the mission, and with whom he was desirous of remaining on good terms pending the establishment of a branch Mission Station at his capital. Further north, the road-making party which commenced operations at Dar-es-Salam has progressed sixteen miles inland, the country being found to improve as they advanced, and the people becoming more friendly, and coming in numbers, daily increasing, to work for wages. At the same time, the part completed is in constant use by the natives, who also have commenced to populate and cultivate the adjoining country, where previously there was nothing but impenetrable jungle.*

* Since this date still more recent intelligence has reached England, that after the most prosperous beginning one of the party was obliged to return invalided, and the Engineer officer is also reported to have returned. This is greatly to be deplored, but it may be hoped means will be found of continuing to a successful termination a good work so well commenced.

"Still further north the line roughly gone over and reported upon by the Rev. Roger Price has been followed up, and a waggon-track made for a distance of 250 miles to Mpwapwa, by Mr. Mackay, in the employ of the Church Missionary Society, while the London Missionary Society's expedition, under Mr. Roger Price, has advanced six days' journey on the route, with cattle and waggons on their way to Lake Tanganyika."

Geographers and Missionaries alike have thus far done their respective parts with untiring energy, and are ready to still further complete the work undertaken by searching out and connecting the few missing links to the main lines. It is for Trade, aided if need be by the State, jointly interested as both are in the realisation of such prospects as these latest discoveries open, and with such strong influences as a Government only can command, to take up the work. To the British merchant and his Government we must now look more especially, for the enterprise and the means which may in a few brief years accomplish the three great ends of so much previous effort—the development of a trade of vast national importance, the civilisation of the African race, and the suppression of a slave-trade exceeding in atrocity all that has ever before darkened the history of humanity. For the last object alone, and irrespective of the other two, this country, since the abolition of slavery in the British dominions in 1807, has voluntarily expended more than 70,000,000*l.*, and is still spending annually, with inadequate returns, a large sum in ships, mixed commissions, and other sources of expense. A very small percentage of such annual outlay vigorously and wisely devoted to further all these objects at this moment—more especially by the opening of practicable roads to the lakes from the East Coast, a work in which the Khedive of Egypt and the Sultan of Zanzibar have both a large interest, and might easily be moved to facilitate and secure—would open Africa more effectually to commerce and to civilisation, as well as to Geographical explorers, and do more to suppress the existing slave-trade than all the ships of the British navy, or any amount of expenditure in other ways.

This brilliant triumph of Stanley, it may fairly be hoped, will renew the lively interest once felt in the object of all Livingstone's labours, and the strong feeling of sympathy for the unhappy victims of a slave-trade in which all that wickedness, greed and cruelty combined can devise seems to culminate. Many objections are frequently urged against African exploration, and for the most part are easily answered. We often hear it argued, for instance, that it is more likely to carry a sword, than peace and good-will among men, into the bowels of the continent; and that the climate will not permit Europeans to colonise Central Africa, which

has moreover few wants, and no products we cannot more easily obtain elsewhere. We are warned that what has occurred before will happen again, according to the inexorable law of Nature —‘the survival of the fittest’—by which, whenever two races come in contact, the weaker and worse will fade away—the stronger and more civilised will supplant the savage—and that it is vain to struggle against this fatality; or why, indeed, should we labour to perpetuate what is bad, and delay the triumph of the preferable and predestined race? It has been further urged, truly enough, that civilised man has always begun by importing the worst vices of civilisation and new diseases which carry off tribes like the plague; so much so, indeed, that vice, disease, and strong drink have been more fatal to savage races than all their own cruelties, sacrifices, slavery, or tribal wars, combined. If, in efforts to eradicate existing evils, we are only to repeat the experience of the past, and import others of a more destructive character, there are few among us who would not argue that the best friends of the African would be those who refuse to aid in the introduction of civilisation, and devoutly wish that Geographers, Philanthropists, and Missionaries would leave Central Africa alone!

These and other objections of a similar nature no doubt prevail to a considerable extent, and must serve greatly to damp the zeal for African exploration. I am so convinced of this, that I must beg your indulgence for a few moments while I touch upon the more obvious reasons for arriving at a totally opposite conclusion. In the first place, the main argument fails because there is no vice or disease that can be imported from Europe with which the natives are not already familiar. The field is already occupied by evil, and is only open to good. As to other exterminating processes, the Africans are, to a great extent, a cultivating and hardy race, with the instincts of labour, tenacity, and resistance. They are spread over an area of some 10,000,000 square miles, with a climate inimical to the European constitution over the larger portion, and a population which has been estimated at some 180,000,000. The data for a census are not of much value, perhaps, but may suffice to show that the danger of extermination by civilising them is small. Men of European race will not kill them off, as they do the Red Indians by destroying their prey, nor as they did the Caribs by working them to death, or the Australians by giving them drink, or the South Sea Islanders by introducing new forms of disease, and carrying them off in a new-born slave-trade. None of these dangers are to be feared now for the Africans. Those

most to be condemned and feared, exist already among the natives, and cannot be aggravated by any foreign influence which can be employed in the present day. Africa must still be for the Africans, for Africa can neither be filled nor tilled by men of European blood, though there are thousands of square miles in the uplands of the great lakes where Europeans might live and thrive. But without any extensive colonisation, they may be converted, civilised, or governed with great and lasting benefit, not only to Africa but to other nations. There are, in truth, few difficulties in the path of improvement and progress in Africa, save such as are common to all efforts of a similar kind nearer home. Civilisation and barbarism cannot, indeed, come in contact without disturbance to the existing conditions of life among savage tribes, and resistance in many cases on the part of those whose benefit is only intended. But if the efforts made are directed by a truly humane spirit, the good must prevail over the evil, and soon occupy the whole field, to the exclusion of all inimical feeling, either on the part of the natives or foreign innovators and intruders. The only real difficulty (where many independent States and agencies engage in the same work) is the want of a supreme and directing power which all will accept. The main object of the King of the Belgians, and the Congress of Geographers and African Explorers he gathered round him at Brussels last year, was so to combine the efforts of all nations as to harmonise their action, and give this single direction for a common end. This may have been Utopian or impracticable, seeing how many conflicting interests and desires must eventually be brought into play. But the difficulty or impossibility of attaining this perfect unity of aim and direction is no sufficient reason for leaving millions of the African race, and so vast a portion of the habitable globe, a prey to barbarism, intensified by all the revolting horrors of a slave-trade which we did so much ourselves, in times past, in common with other Christian States, to sanction and encourage. As to questions of territorial jurisdiction and international rights of commerce, these are all to be dealt with as they arise, by the same means which are employed, with average success, among civilised states.

There is only one objection not hitherto mentioned, and which I must confess does not seem to me to admit of an equally satisfactory or conclusive answer: the difficulty of reconciling conflicting creeds and disassociated Churches, each claiming to be the only orthodox representative of Christianity. The religious discords and wars, from which Europe has suffered so fatally in times past, and is at this moment suffering in Bulgaria and Armenia—where a war, both

of race and creeds, rages under its most ferocious aspect—is not reassuring as to the future of civilisation and Christianity in Africa. Mohammedanism already prevails over the greater part of Africa north of the Equator; and few would wish to see it driven out without being able to substitute something better in its place. But there lies the difficulty and the danger. So long as missionaries of different persuasions are occupied in making converts among the heathen natives, and are sufficiently separated by distance from any danger of interfering with each other's field of operations, the differences among themselves as to forms of Christianity may be of little importance—Romanist and Protestant may each labour undisturbed. But if their converts number millions, as may well come to pass speedily now, and they are not kept apart by safe distance, who can answer for the result? Neither past nor present experience in Europe is reassuring. What it might be at some future day in Africa no one can tell. But this I feel, that if Religion, Commerce, and Education, the three great factors in all modern civilisation and progress, cannot combined tame the savage nature in man, and powerfully promote peace, the conclusion must carry us much further than Africa, and the future destiny of the sable race now occupying its vast area in heathen barbarism. If those influences, separately or collectively, cannot be trusted in the end to bring peace and good-will among men, we must despair not only for Africans, but for the rest of the world, and the destiny of mankind! But as no misgivings of this kind ever prevent nations or statesmen from strenuous exertion to promote all these objects, neither should they prevail to destroy the hopes and paralyse the efforts of Geographer or Philanthropist to improve the condition of Africa, and open up its rich resources for the benefit of the world at large. The Geographical Society, therefore, taking up the question of African exploration with renewed vigour, is continuing efforts that have borne the richest fruit in the discovery of the sources of the Nile, and the great lake and river system of the vast continent, scarcely known, save by vague report and tradition, before Livingstone's first journeys. They have never doubted that the British public will recognise the importance of the work proposed, and give evidence of their confidence in efforts to supply a centre for the organisation of new undertakings to open up Africa both to commerce and to all civilising influences. And as regards the aid or co-operation of H.M.'s Government, there is no reason to doubt that it will, as heretofore, give favourable consideration to any representations that may come to them, in fitting season, from this

Society. If the Portuguese Government, with its comparatively small commerce and interests in Africa, has thought it desirable to obtain a grant of 20,000*l.* from the Chamber of Deputies at Lisbon for the prosecution of exploration of Central Africa from the West, it would be strange indeed should the British Government, or Parliament, with an infinitely larger stake in the future of Africa, both in territorial possessions and in trade, hesitate to promote whatever may tend to secure to Great Britain a full share in the promised advantages of commercial intercourse. Geographical exploration is a means to the end, and the best and most effective instrument which Government can employ.

It is not, as I have shown, a mere question of commercial gain, although that, as the world goes, is an element of no small importance to this country. One of the closing reflections of Livingstone when he had spent so many laborious years in African exploration, will commend itself especially to the national feeling:—"If," he says, "my disclosures regarding the terrible Ujijian slavery should lead to the suppression of the East Coast slave-trade, I shall regard that as a greater matter by far than the discovery of all the Nile sources together." This does not lessen the importance of the other objects, nor my concurrence with Stanley, who says, in concluding his book after finding Livingstone, with reference to African exploration, "It is simply a question of money, which is the sinew of all enterprises. With a sufficient supply of it, all Africa can be explored easily. Not only explored, but conquered and civilised. Not only civilised, but intersected by railroads from one end to the other, through and through."

It is so much and so absolutely a question of money, that the Exploration Committee have not hitherto felt justified in entering upon any serious undertaking or new expedition for exploratory purposes. The whole amount contributed does not yet amount to 2000*l.*, and, without larger resources, nothing really important in the nature of independent and scientific exploration can be attempted. The cost of Cameron's journey and explorations was more than 12,000*l.* We know nothing of the expense of Stanley's expedition, but it may well exceed even this large sum. There is no longer any difficulty or obstacle to the effective opening up of Central Africa and the richest sources of natural wealth and commerce which money properly applied will not speedily overcome. This is the deliberate opinion of the two travellers, Cameron and Stanley, who have seen so much of these central regions, and have seen them later than any other explorer. What the Geographical

Society may properly undertake it is ready to perform if means are provided; but much will still depend upon others—missionaries, merchants and governments—and it is for them to take action if they wish further progress to be made by this country. Other nations are in the field—and there is room enough for all—but it is clear that those who make the first advances will also be the first to reap the harvest. Three high roads for waggons from the East Coast—one to Victoria Nyanza in the north, another to Nyassa from a more southerly point on the coast, and a third to Tanganyika between the two, wherever the best ports can be found—would do all that is necessary to open up at this moment central Africa, and substitute a legitimate commerce for the slave-trade. The Romans, who were the greatest civilisers in the ancient world, always began by making practicable roads, as the first condition of fruitful occupation in a new country—and it is undoubtedly the first and indispensable condition of all progress in Africa. The bullock-waggon and the steam-boat will do the rest, until the time comes—and it cannot be far distant after these have possession—for the rail and the telegraph to complete the work.

It may seem visionary to talk of railroads and telegraph lines for the centre of Africa—since we are only beginning to discover the possibility of making practicable waggon-roads into the interior. But there are no difficulties to be surmounted greater than those which have been successfully overcome in other countries—no tribes wilder or less amenable to control than the wandering bushmen of Australia, or the Kurds and other nomad tribes of Asiatics along the track of the Euphrates telegraphic line.

The longest telegraph-line in existence—we are reminded by Mr. Nicholls in some ‘Remarks on a proposed line of Telegraph Overland from Egypt to the Cape of Good Hope’—is that traversing the Continents of Europe and Asia from West to East. Beginning at St. Petersburg, it extends across the Empire of Russia to the Eastern Coast of Siberia, a distance of 110°, or about 5000 statute miles. In this course the engineering difficulties were at one time considered to be almost insurmountable, for in passing through Siberia it traverses one of the most inhospitable and desolate countries in the world; whilst much of the materials had to be carried immense distances over the most inaccessible mountain ranges, and within the region of perpetual snow.

So in the line traversing the United States from San Francisco to New York. Not only had it to cross the Sierra Nevada mountains, 7000 feet above the level of the sea, thence through the desert of Nevada, ascending the Rocky Mountains at an altitude of

8400 feet, and after threading its way across that immense range, stretch over the prairies for a distance of 700 miles, infested with numerous Indian tribes which are as savage and hostile to the white man as any that can be found from one extremity of Africa to the other. 3300 miles of telegraph-line has nevertheless been erected over these various territories, and is kept working without serious difficulty. The Trans-Andean line, which traverses the South American Continent from east to west, is another striking example of success under unfavourable conditions. Traversing the high and extensive range of the Andes in the region of perpetual snow, it extends for 800 miles to Valparaiso in a direct course. Yet bolder perhaps than all these undertakings, successfully carried through, has been the construction of an overland telegraph-line a distance of more than 2000 miles across the Continent of Australia, and "through a region hitherto considered to be an impassable desert." Food, materials—everything needful for man and beast, and the construction of the line and the stations—had to be carted from either extremity throughout its whole extent. Tracts 50 feet wide had to be cut and cleared through many hundreds of miles of dense forest-scrub. Water was so scarce that wells had to be sunk. Cattle and sheep, to the numbers of many thousands, had to be driven into the interior for the supply of the Expedition for distances extending to 1300 miles out, and back on the return journey. Yet all this has been accomplished within the *last seven years*! What is there impossible in the present day which the courage of men and the appliances of science cannot accomplish? And, if we turn for a moment to the influence of such a work as this in Australia—the difficulties where the returns may well have seemed inadequate or doubtful, and insurmountable at any cost—on the well-being and prosperity of the great continent and the Saxon colonies, which had the enterprise to incur the cost and overcome all obstacles, we shall see a new power and a source of wealth was created. Mr. Nicholls mentions that the colony of South Australia alone netted during the first year after the opening of the line a quarter of a million sterling extra on its wheat harvest, through the telegraph enabling sales to be made in foreign markets.

This is only one of the many ways in which the wealth and resources of a country are indefinitely increased by increased facilities of communication. And who can doubt that what has taken place in the Continent of Australia might equally be expected in Africa, within the next seven years, if the necessary enterprise and means were forthcoming? A telegraph-line from Khartoum—to which place the Khedive of Egypt has already carried his from Cairo—to

the nearest point of our own line in the Cape Colony, and a practicable road, or still better, a light rail to the three great inland seas from the East Coast, would work more wonders than Aladdin's lamp, and the construction of either, or both, presents no difficulties to be compared with those overcome in every other quarter of the globe in recent times. If it be a question whether sufficient inducement exists in the prospects of a large and profitable trade for the employment of capital—the merchant and the capitalist must of course form their own opinion—there is one consideration, however, not to be overlooked. Other countries may produce and be willing to sell us (in time of peace) all that Africa can; but will America, for instance, in selling its cotton, and sugar, and tobacco, to the extent of 20,000,000*l.* or 30,000,000*l.*, take an equal or greater amount of our manufactured goods in exchange? If not, should we not deal much more advantageously with a new country that will, and in all probability on more favourable terms and without hostile tariffs? Every motive that can influence one nation to desire and promote friendly intercourse with another, it seems to me, exists in this instance, and none on the opposite side to deter or forbid the employment of the necessary means.

If I insist upon this view of the present and prospective results of African discoveries and further continuous exploration, it is because I am impressed with the conviction that since the maritime discoveries of the fifteenth century opened a new route to India and China, and revealed a new world, there has not been so magnificent a field, not only for geographical research, but for enterprise of every kind, and philanthropic labours. Magnificent not only in extent of area and largeness of population, but in the possible results to the world at large, as well as to the African race, from the opening up of the whole continent to commerce and civilisation. Geographers have not for several centuries had so important a part to play in the destinies of a race, nor have the more strictly scientific features of their work often had so obvious and practical a value in developing the resources of a great country, furnishing the knowledge on which all progress must be based. But it is time I drew these remarks to a conclusion. I fear they may indeed have overtaxed your patience; yet the importance of the subject will, I hope, plead my excuse. Whether the giant strides made in the last few years by geographical discovery is to be followed by equally vast and rapid changes in the condition of Central Africa, and the whole Continent stretching from Egypt to the Cape of Good Hope, must depend, as I have been at some pains to show, upon the means which individuals or governments may

bring to bear. It is mainly a question of money and employment of capital. All other means will fail without this *primum mobile*; and with it, nothing in the existing physical and moral condition of the African Continent or people can offer any serious obstacle. I can only express a hope, in which I feel confident all who are present will heartily join, that Great Britain, so long in the foremost rank, will not be the last on the muster roll of those countries which are destined to bring the African race and the inexhaustible wealth of their fertile soil, their mineral products, and free labour, within the circle of modern civilisation, and under the safeguard of public law and humanising influences.

The PRESIDENT said the Paper about to be read was an interesting account of Unyamwesi by M. Broyon, who had settled in the kingdom of Mirambo, in the interior of East Africa, and had married that monarch's daughter.

The following Paper was read by Mr. C. R. MARKHAM, Secretary.

Description of Unyamwesi, the Territory of King Mirambo, and the best Route thither from the East Coast. By PHILIPPE BROYON-MIRAMBO*.

PHILIPPE Broyon, son-in-law of King Mirambo, was born at Bex in Switzerland. He belongs to a very good family, and is about thirty-two years of age. At about the age of eighteen, he embarked as a seaman on board the brig *Ville d'Aigues-Mortes* for Zanzibar. After a second voyage to East Africa he determined to remain at Zanzibar, and he served in the offices of a trading-house there for some years. Longing for farther travel and adventure, however, he gave up this employment and went over to Saadani on the mainland, where he joined a caravan which was going to the interior, and with it reached Urambo in Unyamwesi. Arrived there, he formed a close friendship with Mirambo, the king of the country, who, after going through the ceremony of blood-brothership with him, gave him his daughter in marriage. M. Broyon has two children, the elder of whom he brought with him on his last journey to Zanzibar, to leave him to be educated by the Fathers of the French Mission there.

M. Broyon is a very energetic, intelligent, and courageous man, with quite sufficient knowledge to enable him to make accurate observations. He has sent to the Geographical Society of Marseilles an account of the little-known country of Unyamwesi, and a map showing the route which is followed by the caravans, in passing from the East Coast, to Urambo the capital of Unyamwesi.

* From the 'Bulletin de la Société de Géographie de Marseille.'

M. Broyon set out again from Zanzibar for Saadani and Urambo on the 20th of May (1877), taking with him instruments for geographical observation, and promises to send to the Marseilles Society an account of his journey. He was of opinion that the rains, which are very heavy in June and July, would oblige him to remain for a month or a month and a half at Mpwapwa, before crossing the great marshy plain of Ugogo; but he counts on being at Urambo before the end of September, and intends to make only a short stay there, and to return to Zanzibar about the end of this year.

He believes this Saadani route to be the best, the most direct, and the safest, the caravans being under the protection of allies of King Mirambo; and it has this advantage over the Bagamoyo route, that it avoids the crossing of the River Wami. Saadani is also just as near to Zanzibar as Bagamoyo, and is in daily communication with it.* The route by Unyanyembé should be avoided by future travellers, as it is in the hands of the Suaheli Arabs, and has become the resort of tribes who make a living by pillaging or fleeing the caravans.

UNYAMWESI.

Unyamwesi extends between 32° and 34° E. of Greenwich, and from $2^{\circ} 30'$ to 6° s. lat.; it is bounded on the north by the Victoria-Nyanza, on the south by the countries of Uvuendé-Mpimbué† and Kiuéré‡; on the east by Uyanzi and Ituru, and on the north-east by the numerous tribes of the Masai; on the west by Ussui, Uhha, and Uvinza.

The great family of the Wanyamwesi is divided into six branches, or large tribes, which, although very distinct from one another in general appearance, are very similar in respect of language and customs.

1. The most intelligent and active of these tribes is that of the *Wagaranza*, which inhabits the central part of Eastern Unyamwesi, and which is consequently the nearest to the coast. This tribe is chiefly given to trading in ivory, which they go to purchase far in the west; but since the Arabs have been established at Unyanyembé, they have taught the Wagaranza to become robbers, and send them to make *razzias*, for slaves and cattle, on the peaceable

* Two English missions are established at Saadani; the one directed by Mr. Price, the other by Mr. Mackay, who is working at the construction of a road to the lakes.

† (?) Ukawendi or Kowendi and Mpimbwe of Stanley and Cameron.

‡ Kiwere of Stanley, Kiwelé of Speke.

Wasekuma. The Wagaraganza originally possessed no cattle; and this is shown by the repugnance which they exhibit to take charge of those they now possess, for they leave them, as a rule, to the care of the Watussi, a foreign people, about whom we will speak presently.

(2.) A second tribe, that of the *Wassumbua*, also called Wana-mueri ('People of the West'), live in the western districts of the country. These people only differ from the Wagaraganza in their excessive vanity and the deserved reputation they have for mendacity and intrigue: on the other hand, however, they are in general more decorous and polite than the other tribes. They also carry on an extensive trade with the coast.

(3.) The third tribe, that of the *Watakama*, lives in the south-west, and differs little in its characteristics from that of the *Wassumbua*.

(4.) The fourth is that of the *Wakonongo*, who dwell in the south of the country. They are poor, and can hardly be said to own any herds, but they are good and very industrious agriculturists. They have no traffic at all with the coast. One detail of their toilet gives them a singularly ludicrous appearance; that is the threading by the men, of beads of various colours upon their beards.

(5.) The north-west is inhabited by the *Wazinja*,* or Wafioma, of whom I know but little.

(6.) In the north, extending as far as Kagehyi on the Victoria-Nyanza, are the Wasekuma; although they bear a bad character, the Wasekuma are not courageous, but they have only their assegais for arms against the guns of the Wagaraganza. They can scarcely be called agriculturists, but they have innumerable herds of cattle and sheep, so that Usekuma has become the depôt for the supply both of beef and of slaves for the Arabs. From time to time the Wasekuma are to be seen driving great troops of cattle and sheep towards Ugogo, where they exchange these for inferior ivory and rhinoceros-horn, which they then take to the coast to barter for beads and copper-wire.

We have just noticed that the Wagaraganza, the Wassumbua, and the Wafioma voluntarily give over the charge of their herds to the *Watussi*, whom I have not included in the list of the various tribes of Unyamwesi. Previous to the reign of Mirambo, the Watussi, a foreign people from the north, tyrannised over all the tribes of Unyamwesi, who, in consequence of the dissensions which prevailed between their various chiefs, were not able to resist the united

* Natives of Usinza, of Speke.

strength of the Watussi. These last also, although they became scattered over the whole land, and had no recognised leaders, always kept themselves distinct and separate, never uniting in marriage with a people whom they considered their inferiors, and against whom they were closely combined. If a native of Unyamwesi happened to possess any cattle, the Watussi interfered under pretext of taking care of the animals and driving them to pasture; but not content with taking the milk, they used to lance them to drink the blood, of which they are ravenously fond, till at last the M'nyamwesi found himself only the nominal proprietor of skeletons which died off rapidly. This state of things has been quite changed since Mirambo united all central Unyamwesi under his rule, and the Watussi, from being masters here, have become the servants: they are even forbidden to build their huts within the village walls: and now make little enclosures outside the villages, in which they group their peculiarly-shaped dwellings.

Although the Wanyamwesi are now almost universally clothed, men and women, in cotton stuffs brought up from the coast, the M'tussi keeps strictly to his primitive costume, which for the men, consists of two flaps of goat-skin held up by two thongs which cross on the breast and back; for the women, the dress is formed of a whole cow-skin, tanned and softened so as to give almost the appearance of cloth: they dye these brown or black, and enliven them with beads. The Watussi are more intelligent and industrious than the generality of the Wanyamwesi; it is they who draw out the fine copper threads with which they make the *niérérés*, a kind of ring of the thickness of a millimètre, composed of giraffe-hair bound spirally with the metallic thread. Women of this tribe are to be seen who have more than a thousand of these on each leg, when they appear as if encased in huge boots. The Wanyamwesi also wear this ornament, which was introduced among them by their old masters, the Watussi. The M'tussi is also a maker of baskets and of mats.

The inhabitants of Eastern Africa may be considered to be divided into two great and distinct races; the one, which seems to belong to the northern hemisphere, is distinguished from the other, which comes from the southern, not less in physical characteristics than in language and customs. The northern people are generally of tall stature, with slender limb, and long and silky hair, and rarely show the true negro profile; their languages are guttural, almost without vowels; they are warriors, hunters, and shepherds, and seldom touch vegetable food. Such are the Gallas, the Masai, the Watussi, and other tribes with which I am not

acquainted. The southern race, on the contrary, have the nose flattened out, thick lips, the hair woolly and curly, the body strong and bulky. Their dialects ring with noisy vowels (the Ki-suaheli is one of these idioms). To this race belong the Wanyamwesi, Wagogo, Wazigua, &c., and all other tribes south of the Equator. They live chiefly on grain and vegetable diet: although they breed cattle, they rarely eat the flesh. They are also less brave and warlike than the people of the north, and this is no doubt the reason why the Northerners have poured like a flood over the lands south of the Equator, through a breadth of fully six degrees of latitude, and exercise a sort of tyranny over the inhabitants of these regions. Thus in Usagara and Ugogo, the Wahumba, although few in numbers, are the rulers, and control the chiefs at will: in Uyanzi, the Wataturu dominate; and in Uvinza and Uhha, the Watussi. Further north still, the representatives of the southern race are to be found only in a state of servitude.

It may be remarked, in passing, that the tribes from the north prefer iron and beads of dark colours, just as the people of the south choose copper and bright colours for their clothing and ornaments.

King Mirambo has made Central Unyamwesi a kind of empire. Although each chief or kinglet is allowed to remain ruler in all that concerns the interior government of his country, he is obliged in case of war to march at the head of his troops, under the orders of the supreme chief, without troubling himself whether he is going or why he should fight. Any infraction of these orders is punishable with death, and the successor in such a case is always named by Mirambo, who selects as a rule one of the same family as the condemned chief. Mr. Stanley, in his book 'How I found Livingstone,' has described Mirambo as of unknown birth, once a porter or slave of an Arab, then chief of a band of brigands who harried the forests of Uliankuru, and lastly as the usurper of the little kingdom of Iovah, of which he had made himself king by main force. Mr. Stanley has been led into error by the Arabs, who do everything they can to vilify their enemy. Here, however, is the information which I have gathered about this remarkable man from good authority in the country which gave him birth.

M'tura, of the Wagaraganza tribe, youngest son of Moto, King of Uliankuru, married the daughter of M'vula, King of Iovah. The latter died without leaving a son, and his nephew Kassanda, son of M'tura, was named as his successor. Kassanda had three sons, M'tura, Mirambo, and Kironga: at the death of his father, Mirambo was named by the patriarchs of the country as his successor; but M'tura, incensed at being deprived of his right as firstborn, rallied

round him some of his father's warriors, declared war on his brother, and burned a great many villages in Iovah: lastly, beaten and pursued, he took refuge with the chief of Uiuĩ, near Unyanyembé, and Mirambo remained sole master of the kingdom. Later on, when he had further strengthened his position, he gave his younger brother, Kironga, the sovereignty of the country of Urunguã, over which he had a claim through his mother.

At the time when Mirambo was only a *Muananguã*, or prince, he was sent several times to the coast in charge of ivory-caravans belonging to his father, who entrusted him with his commercial affairs; and this has sufficed to give a foundation to the Arab story that Mirambo was formerly a porter in their pay.

In all the provinces forming this relatively independent kingdom, the government is hereditary: and the rank occupied by each chief is indicated in the manner in which he is saluted by his inferiors. The king, or *M'temi*, is termed Muami (Majesty) when he is personally addressed, and is saluted by genuflexion and three hand-clappings, followed by the sacred word of the Waniamuesi, "Kassinde." The brothers and children of M'temi have the right to the title of *Muananguãs*: their subjects salute them by bowing deeply, and at the same time joining the hands and pronouncing the name of the father of the reigning M'temi: the nephews of the king have the inferior title of *Zikuru*, and are only saluted in their uncle's name. The slaves who belonged to the father of the reigning king have the right to the same honours and title as the Zikurus. Every chief or king maintains a band of armed slaves, to execute his orders, and to accompany him when he goes abroad; these body-guards never leave him, and take the name *Waniakuru*: it is from them that the governors of distant villages are chosen, and whoever is invested with such a charge takes the title *M'gahué* (prefect), and acquires the right to wear the Kivuenguã—a shell from the coast, which is attached round the neck by a strip of lion-skin.

The M'gahués are entitled to the same honours as the Zikuru. Every person belonging to the following of a chief, or invested with any charge whatsoever, has the right to wear the Kivuenguã: the king also wears it on particular occasions.

When an individual, of royal birth, but of a distant branch of the reigning family, comes into power, all the family of the ex-king retire, and each takes the title of *Muananguã-Waniamalonga*, which signifies 'Prince of Ruins,' because each new chief destroys the village of his predecessor, if it happens to belong to another branch of the family, and builds himself a new one: this applies to the capital only.

The Waniamalongas retain a certain amount of consideration with their title of Muananguâ: they may wear the Kivuenguâ, but have not the right to attach it with the strip of lion-skin, at least if they are not invested with any special charge by the reigning king. They form a sort of aristocracy, poor, unseated, but honoured withal.

The Wanyamwesi believe in a God, and worship their ancestors. They are very superstitious, and even a conquering chief would fear to irritate the *manes* of chiefs long since dead, by arrogating to himself the right to rule over a country in which he had no ancestral ties, either in the reigning family or in those of the Waniamalongas. This is the reason why Mirambo, when he deposes a rebellious chief, always chooses his successor from the family of the ex-king.

One of the plagues, not only of Unyamwesi, but of all Eastern Africa, is the belief in magicians and sorcerers. When any one dies, and there is any reason to suppose that he has been poisoned or bewitched, the diviner is sought out, who, to maintain his reputation, names some one at random or by design, generally a woman, who is seized and tortured to death. The Wanyamwesi, but chiefly their women, have the reputation of being poisoners. I have on several occasions had proofs that this charge is not without foundation; but many, also, who perish are perfectly innocent. When a chief has a dream that makes a little impression on his imagination, he goes to the magician to have it interpreted: the replies vary according to the wishes and purposes of the diviner. Sometimes he replies to the chief that the spirit of his father orders him to kill some cattle over his tomb, and to distribute the flesh to the poor (without forgetting the diviner, of course), or to hang vestments up in the entrance to the grave at night-fall. On the following morning these have disappeared: it is the spirit, naturally, that has been anxious to clothe itself.

The most superstitious of the Wanyamwesi are the Wasekuma: they are always loaded with talismans and amulets, and generally the diviners and medicine-men come from this tribe.

The Wanyamwesi are polygamists, and may take as many wives as their means will permit. When a young man possesses a few iron hoe-blades, some beads, or one or two "doti" of cotton-stuff, he is in a position to marry. He begins then, with the aid of some of his friends, to build a hut; that finished, he offers his goods, through the mediation of a friend, to the parents of the girl he desires to have for his wife. After some debate, the bargain is concluded, and the *fiancée* at once enters into the business by pre-

paring the pombé, or millet beer—the favourite beverage of all the people east of the great lake—against the wedding-day. On the day of the marriage, the father of the bride gives, according to his social position, it may be an ox, a sheep, or some fowls for the feast, to which all the village is cordially invited; and the tam-tam is in great force. After this ceremony, the husband has almost the right of ownership of his wife. If she deserts him, or if her conduct makes it desirable, she may be sent back to her parents, who are held responsible either to return the goods that were given for her, or to provide another wife.

The long period during which Unyamwesi has been subject to the yoke of the Arabs of Unyanyembé, has left its traces. One custom instituted in former times by the Arabs for their profit still remains, in spite of the check which Mirambo has placed on their despotism. Thus, when a woman is maltreated by her husband, if she breaks any dish or weapon belonging to the chief of the village, she becomes by this act his slave, and is not given back to her husband unless she herself consents to this, and unless he pays a ransom for her to the chief. The Arabs, when they were in power, established this custom, and extended it to such a degree that any native, of whatever rank or sex, who broke or carelessly injured any article belonging to an Arab, was declared a slave, with all his family; all were fettered and sent off, either to Unyanyembé to be employed in the fields there, or westward to Tanganyika, to be exchanged for ivory among the Wamanyema cannibals, who fattened them up for eating.

As the villages are not generally inhabited by others than the descendants of the founder, sometimes the whole population of one of these was to be seen in chains, and the Arab who a day or two before only possessed some bundles of cotton goods, advanced to him, it may be, by a Banyan of Zanzibar, was a rich man by a single stroke, and could set up house at Unyanyembé, in the sumptuous style of life so well described by Speke, Stanley, and Cameron.

The Wanyamwesi do not generally bury their dead: this is reserved for the kings and chiefs, and the chief *muanguás*. When a chief dies, the body is laced up with cords in the position of a man squatting, the head between the knees and the hands closed over the eyes. The body is then lowered into a circular pit, of about two yards in depth, and reposes on a sort of circular seat or board much smaller than the bottom of the grave. Over the tomb is built a small hut of circular form, surrounded by a strong palisade to prevent unclean animals from penetrating to it. A chief never sets out on any warlike expedition without first making sacrifice of

animals, chiefly oxen and sheep, over the grave of his father, and the same takes place on returning.

The Wanyamwesi never inter their chiefs in company with living slaves, and the travellers who have reported this have been quite mistaken.

I do not wish to conclude without saying a word about the productions of Unyamwesi. All the south and west of the country yields iron in abundance. The people dig out the mineral and forge iron of various qualities by a very ingenious method. On the frontiers of Uvinza, in Usumbua, there are salt-beds giving a salt of very fine grain and a little bitter in taste.

Much rice is cultivated, besides mtama (sorghum), smaller millet, sweet potatoes, yams, ground-nuts, beans of all sorts, tomatas, citrons, and bananas in abundance.

The Wanyamwesi, although they are travellers and traders, generally remain at home at seed-time and harvest; they are for the most part good agriculturists, and for this reason provisions are always abundant in their country. In Usekuma there is very little cultivation, but the pasture lands are very extensive; and there butter and milk and wild honey may be obtained very cheaply.

I am not in a position to give geographical data about these regions, for as I have travelled solely for commercial objects, I have not hitherto had the requisite instruments.

The PRESIDENT, in calling upon Mr. Edward Hutchinson, of the Church Missionary Society, to tell the Meeting the latest news of the Missionary parties on Victoria Nyanza, expressed the hope that Christian possession might be taken of King M'tesa's country, thus making five million converts in one effort.

Mr. HUTCHINSON said the President's remarks with regard to the future of Africa must have found an echo in every heart. There was very little doubt that the vast continent of Africa presented a most important field for English enterprise. There was no reason whatever why, in prosecuting enterprises of this kind, the trader, the geographer, and the missionary should not work side by side, or why, among Christian gentlemen, there should be any divorce in such matters. He wished to call attention to the fact, that in Africa two Missionary Societies were labouring side by side. No doubt Sir Rutherford's experience in China had taught him what difficulties arose from the introduction of various forms of Christianity into heathen countries; but the Church Missionary Society and the London Missionary Society afforded an illustration of how those who really had the welfare of a country at heart might work harmoniously together. Sir Rutherford was perfectly right in saying, that, in dealing with the future of Africa, enterprise should proceed from the East Coast. Those who were really interested in the matter had resolved to begin from the East Coast. It was felt that if anything great was to be accomplished, there must be some radical change in the system of portorage; and it had been determined, after the fashion of the old Roman explorers, to pierce Africa with a good road. This idea was first mooted at a meeting of the African Section of the Society of Arts. All who were in-

terested in East Africa were much indebted to the researches, energy, and information furnished by Dr. Kirk. One of the great obstacles to penetrating Africa was the presence of the tsetse fly and the network of marsh, morass, and rivers; but Dr. Kirk had pointed out that to the north of the river-system of which the Wami was the centre, there was a higher level of country where the tsetse fly did not exist. The Church Missionary Society determined to be in the field as soon as possible; but, for all practical purposes, the London Missionary Society were before them. While the Church Missionary Society decided on first of all exploring the Wami and the Kingani, to see whether the hopeful view expressed by Mr. Stanley was correct, the London Missionary Society resolved to try bullock-waggons, and they found that in the direction indicated by Dr. Kirk there was a level country available for their purpose. The Church Missionary Society finding that the rivers could not be utilised as a means of penetrating into the interior, told off a party for the purpose of making a road. Sir Rutherford Alcock and Mr. Stanley had spoken of money as being all that was required in Africa, but suitable agents were just as necessary. In this respect the Church Missionary Society were most fortunate; for they had in their service a young engineer, Mr. Mackay, who went out to Africa intending to go with the Nyanza party, but he was told off to make a road, and now there was a fairly available road, 250 miles in length, suited for bullock-waggons and carts between Saadani and Mpwapwa; and on the 18th August, the London Missionary Society's agents had reached a station 150 miles inland on that road, having with them waggons and carts which had superseded the old fashion of employing porters' heads. There was no doubt that Mirambo was a very shrewd fellow, whatever his origin. His position seemed to be rather like that of Romulus and Remus in the old days. He had fought against the Arab slave-trade, and he had gathered a great number of men around him who had formerly been victims of that trade. They treated Camerou well, and the moment that Mirambo heard that there were men coming to the East Coast with carts and waggons, he sent M. Broyon to purchase such waggons and carts as the London Missionary Society had to spare, and was going to establish on his own account a service of bullock-waggons over the road which the Church Missionary Society had formed. The Church Missionary party were at Kagéi on the 29th of January, on the southern shores of the Victoria Nyanza, and when the last letters were sent off in June, they were about to start from the island of Ukerewe. They had visited that island, and their letters spoke most pleasantly of the King and his government. They considered that the island afforded proof that the Africans were capable of responding to a settled form of government. Those who were familiar with Mr. Stanley's letters would remember his mentioning an Arab called Sangoro, who had built a dhow on the island for the purpose of carrying on the slave-trade. He was glad to say that Sangoro's devices had come to an end. The Church Missionary Society's agents had purchased the dhow, and the party had started with a little launch built by Messenger, *The Daisy*, to attempt the ascent of the Kitangule river on the N.W. borders of the lake. They intended to leave two of the party at Rumanika's capital, while the remainder would go on to M'tesa in order to respond to the invitation which had been received from him. The information received from Colonel Gordon satisfied the Church Missionary Society that, in some strange way, M'tesa distinctly believed himself to be a Christian, and was longing for the presence of Christian teachers. Through the facilities which they had reason to hope would be afforded by the Egyptian Government, the Society would be able to send missionaries or supplies up the Nile. With regard to the Belgian Expedition, he hoped they would make no attempt to establish themselves at Unyanyembe, which was a fatal place for Europeans. The Church Missionary party were laid up there for a month by a most disastrous

attack of fever. The Belgians would find Mininga a much more suitable spot, as it was a healthy place with abundance of water. Sir Rutherford Alcock had referred to what was being done on the Niger. A steamer has been specially built for missionary and pioneer work under Bishop Crowther, and the Church Missionary Society would do all in their power to work harmoniously with the Royal Geographical Society, should that society wish to make any exploration on that river.

The PRESIDENT said he trusted that what had been said would increase the interest which was felt in one of the greatest enterprises of the present day, namely, the opening up of Africa. For the first time it had become a possibility, and it was merely a question of money whether it should be done speedily or at all. The information which had just been given by Mr. Hutchinson was particularly satisfactory; for when the nations of Europe were in a state of barbarism, the chiefs or kings were first converted to Christianity, and then the subjects followed. No doubt the same thing would take place in Africa, and it was therefore with great satisfaction that he had heard that the Church Missionary Society was just on the point of presenting the necessary facilities for the whole 5,000,000 subjects of King M'tesa becoming Christians.

Second Meeting, 26th November, 1877.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*J. N. Gordon, Esq.*

ELECTIONS.—*Commander Walter B. Bridges, R.N.; Joseph Brooks, Esq.; Nathaniel Cantley, Esq.; Arthur Cates, Esq.; Edward Richard Christie, Esq.; James Cox, Esq.; Captain Arthur Thurstan Crosse, 52nd Light Infantry; Frederick Derry, Esq.; William Dryland, Esq.; Commander William George England, R.N.; Alphonse Estoclet, Esq.; Alexander Finn, Esq.; Ernest Badinius Florence, Esq.; Captain J. S. Hay, Inspector-General of Houssa Forces; E. Nelson Haxell, Esq.; Henry Burdett Hederstedt, Esq.; Thomas Francis Hughes, Esq.; John W. Hutchinson, Esq.; Richard F. Keane, Esq.; Seton Laing, Esq.; Thomas Leighton, Esq.; Joseph Isaac Cohen de Lissa, Esq.; Marcus Tertius Moses, Esq.; William Nicolle, Esq.; Lieutenant-General Sir H. W. Norman, K.C.B.; Major Edward Lacon Ommannney, Bengal Staff Corps; Henry Porter, Esq.; Thomas Ernest Phillips, Esq.; Edward Ellison Prichard, Esq.; Alexander Reid, Esq.; John Thomson Rennie, Esq.; Edward Stanford, Jun., Esq.; James Stevenson, Esq.; Edward William Streeter, Esq.; John Siltzer, Esq.; Arthur Todd, Esq.; Rev. Henry Toovey, M.A.; Charles Ward, Esq.; Colonel John Wilson, Madras Staff Corps.*

DONATIONS TO THE LIBRARY, 12TH TO 26TH NOVEMBER, 1877.—*Travels in the footsteps of Bruce in Algeria and Tunis, by R. L.*

Playfair, 1877 (*Author*). Informe de la Exploracion de los Rios Perene y Tambo, por A. Wertheman; Lima, 1877 (*Author*). Letters regarding the subject of trees, forests, and rainfall, and the natural irrigation of the treeless Deccan, by E. W. L. Morant; Bombay, 1877 (*Author*). An account of the latest exploring expedition across Australia, by W. H. Tietkens, 1877 (*Author*). Vol. xxxv. of publications of the Topographical Bureau, St. Petersburg, 1877 (*General Gorloff*). Rates of Chronometers on trial for purchase by the Board of Admiralty at the R. Observatory, Greenwich, 1877 (*The Observatory*). Catalogue of special loan collection of scientific apparatus, S. Kensington Museum, 3rd edn., 1877 (*The Science and Art Department*). Report of the Meteorological Committee of the Royal Society for 17 months ending 31st May, 1877 (*The Committee*). Remarks on Davis Strait, Baffin Bay, &c., to $82\frac{1}{4}^{\circ}$ N., 1875, and Tide Tables for the British and Irish Ports for 1878 (*The Lords Commissioners of the Admiralty*). Tableaux de population, &c., pour l'année 1873; Paris, 1876 (*The French Minister for the Marine and Colonies*). Chimie à l'usage des Ingénieurs, &c., No. 4 of Agendas Dunod; Paris, 1877 (*Editor*). Wassermenge und Suspensions-schlamm des Amu-Darja in seinem Unterlaufe, von. C. Schmidt & F. Dohrandt, St. Petersburg, 1877 (*Authors*). L'Esploratore, Milano, Nos. 1-4. And the current issue of publications of corresponding Societies, periodicals, &c., &c.

DONATIONS TO THE MAP-ROOM BETWEEN THE 12TH AND 26TH OF NOVEMBER, 1877.—An original MS. tracing of a Map of Tahiti, with remarks by the Author. (*Presented by Mr. John Findlay, F.R.G.S.*)

THE PRESIDENT, in introducing the subject of the evening, said the Society had heard a great deal lately about the unknown regions of Central Africa, and he was not sure that they were not open to the charge of having been too much absorbed in that interesting field of exploration. There was probably sufficient to justify them in what they had done; but they by no means intended to confine their attention to one quarter of the globe only. Although it might not be very generally known, he believed that it would be found that in the South American continent there were vast regions almost as unknown as the wild and cannibal-haunted regions along the course of the Congo. The first Paper to be read was on Bolivia, by Commander Musters, who had lived there for some years and obtained some very valuable information, by which he had been able to correct the errors of our maps. The second Paper, by Mr. Markham, consisted of notes on the other unexplored parts of South America. When the Spaniards and Portuguese overspread the South American continent, the geography of the districts as delineated by them was generally accepted by all cartographers, but the fact was that very little was accurately known of any part except along the coast and a little way into the interior. There were one or two gentlemen present who had spent some time in those regions, and who, he trusted, would give the Society the benefit of their personal experience, and so contribute to the instruction of the Meeting.

The following Papers were read by their authors :—

1.—*Notes on Bolivia.* By Commander G. C. MUSTERS, R.N.

[This Paper will be published in the 47th vol. of the 'Journal,' now in the press.]

2.—*The still Unexplored Parts of South America.* By C. R. MARKHAM, C.B., F.R.S., Secretary R.G.S.

THE occasion of receiving from Captain Musters some account of his geographical work in Bolivia seems appropriate for bringing to the notice of the present Meeting the extent of the region which is still unexplored in South America. Such a review may help to dispel the delusion that discovery and exploration are nearly at an end, and that henceforth this, the most important and interesting part of the work of this Society—will have to give place to scientific deductions from the work of former explorers. This delusion seems greatest when we think of the vast unknown region round the North Pole, and of the interiors of Asia and Africa. But in South America, too, there is still exploring work which will suffice for more than one generation.

The work of geographical exploration is divided into three stages. There is first the report of the pioneer explorer who penetrates into a previously unknown region. There is next the more detailed work of the topographical surveyor in a country hitherto unmapped and imperfectly known. Lastly, there are the operations of the trigonometrical surveyor and the physicist. In South America there is still much work of the first kind, a still vaster area imperfectly explored, while the third and final stage of geographical exploration has not been reached in any part of the continent. So that in this division of the globe there is plenty of work for this Society for generations to come.

Commencing our review from the south, there is much that remains undiscovered in Patagonia and the extreme south of Chile, and still more that is, as yet, very imperfectly explored. The surveys of the Patagonian coasts and islands are even yet incomplete, though the work of FitzRoy and King has lately been supplemented by Captain Mayne, and by the Chilian officers. One of them, Captain Simpson, who is present among us this evening, has done most valuable hydrographical work. The labours of Captain Simpson and his brother officers have been recorded by

Captain Vidal Gormaz in those admirable annual Reports published at Santiago. As regards the interior of Patagonia, Captain Musters was the very first traveller who ever traversed that wild region from south to north, and this fact alone shows how much remains to be done there. I have just received a letter from Señor Moreno of Buenos Ayres, who recently explored the River Santa Cruz in Patagonia, and had the gratification of reporting to his Government that the "Plains of Mystery," so named by Admiral FitzRoy, no longer corresponded to their name. But he still speaks of the greater part of Patagonia as practically unknown. Yet enough is known to enable him to say with confidence that the unexplored region conceals immense palæontological and ethnological treasures, entirely new material for zoological and botanical studies, and geographical features of great interest. Señor Moreno himself has already done much to throw partial light on what is still unknown. Besides his Santa Cruz expedition, he has visited the lake of Nahuel-huapi, and has undertaken other excursions into Patagonia. He has also made important ethnological and geographical discoveries, including the collection of skulls closely resembling that of Neanderthal, and numerous fossils. I mention the labours of this distinguished Argentine geographer, first, to show how much is still unknown in this part of South America, and secondly, because the Meeting should know that the interests of geography are not neglected by South Americans, and that, although there is much to be done, progress is being made by able and zealous explorers.

Proceeding northwards we next come to the "Gran Chaco," where there is a vast unexplored region within the basins of the Paraguay, Pilcomayo, and the Vermejo. Although Captain Cilley has done a great deal of good work in the upper Paraguay basin, the course of the Lateriquique is still entirely unknown. In the actual sierra of Bolivia Captain Musters and his colleague Mr. Minchin, as well as Mr. Mathews, have for the first time constructed maps with any approach to accuracy, and have fixed numerous positions. They have thus rendered very important services to our science, and geography is no less indebted to Colonel Church for his valuable additions to our knowledge in the basin of the Madeira, and of its tributaries the Beni and Mamoré. Still there is a vast extent of interesting country which is practically unknown in the provinces of Lipez, Chichas, and Carangas, and especially round the western side of Lake Poopo. In many respects the Andean system is, to the physical geographer, the most interesting mountain mass in the world, for here the phenomena of earthquakes may be

studied on the largest and most awful scale, here are volcanic chains extending hundreds of miles, and fossiliferous Silurian rocks raised in the form of mountain peaks 20,000 feet above the sea. Here, too, the meteorological and other physical phenomena connected with mountain chains are of peculiar interest. Yet the orography of western South America is very imperfectly understood, and this is particularly the case as regards the peaks and ridges of south-western Bolivia, where Sajama is shown (on Colonel Church's map) to attain a height of 22,350 feet. Mr. Minchin has fixed the height of Illimani at 21,040 feet, and Illampu at 21,470. Do the peaks of the volcanic coast range, or those rising from the fossiliferous wall of the eastern Andes, attain the greatest height? This is one among many geographical questions of great importance, for the solution of which we must wait until men like Musters and Minchin have been over the whole ground.

In the vast region of the Madeira basin, which has been the scene of Colonel Church's invaluable labours, there is a yet more extensive unknown area, over which historical tradition has thrown a halo of romance. The scenery of the eastern slopes of the Andes is unsurpassed in magnificence and beauty in any other part of the world. The lovely valleys lead down towards an unknown region, into which thousands of the Ynca race fled from the conquering Spaniards, and where tradition placed the fabled riches of Encin and the Gran Paytiti.

The most recent official Brazilian map of the Madeira and Purus, communicated by Colonel Church, is exceedingly valuable, but it serves to show how incomplete is our knowledge of the Madeira river-system, and how much remains to be done. I descended the valley of the Tambopata for some distance in 1860, and Señor Raimondi has since followed up my footsteps, but beyond my furthest point the country and the courses of the rivers are still unknown. The courses of the Caravayan rivers, descending from slopes which are probably as rich in auriferous deposits as any equal area upon the surface of the globe, are also unknown. The physical features of this Caravayan region are expressly interesting, because the little that is known indicates the existence of a range analagous to the Sewaliks at the foot of the Himalayas, and of long lateral valleys like the duns of India. Mr. Saunders has endeavoured to give expression to these features in his map of the empire of the Yncas.

But the most important portion of the unexplored region in this part of South America is undoubtedly the basin of the Madre de Dios, the river which drains the Montaña of Cuzco, the imperial

city of the Yncas. Geographers long supposed that the Madre de Dios was a tributary of the Purus. This was the opinion of Father Bovo de Revello; and I received that impression from him when I explored the valley of the Tono as far as the Madre de Dios in 1853. I was then very young, and with no resources, without followers, without food, and without shoes. The good Father almost forced me to return to the Andes, but I did so with extreme regret. Lieutenant Gibbon afterwards reached and turned back nearly at the same point; and the Madre de Dios remains to be explored. The admirably executed discoveries of Mr. Chandless have since proved that the Madre de Dios is no part of the Purus system: and his scientific exploration of the Purus and Aquiry, which won for him the gold medal of this Society, is a model of geographical work of the highest order. Colonel Church has collected much information respecting the Madre de Dios and other important tributaries of the Beni. Still the work of discovery in this region remains to be achieved.

Professor Orton, of Wassar College (New York), justly attached so much importance to the exploration of the basin of the River Beni, that he made a special journey to Peru in 1875 for the purpose of undertaking it. His scientific attainments and excellent qualities as a traveller made it certain that geography would reap great benefit from his researches; and no doubt he had time to collect much valuable material. But the melancholy news of his death arrived by the last mail. He was taken ill in the territory of the Moxos, and, dying at Puno, was buried on an island in Lake Titicaca, almost on the threshold of his intended discoveries.

The head-waters of the Ucayali were as unknown as those of the Beni, until the energetic efforts of scientific officers in the employment of the Peruvian Government completed a preliminary exploration of them in quite recent years. The Society has only just received a copy of the Report of Mr. Wertherman, who, accompanied by an English naturalist named Whiteley, has been the first to discover the course of the important River Perene from the Andes to its junction with the Ucayali. This achievement is one of great geographical importance, and will doubtless lead to the more complete exploration of a region respecting which our knowledge is very scanty. The portion of the chain of the eastern Andes, with its ramifications, where are the sources of the Perene and other affluents of the Ucayali, is very little known, and its treatment on most maps is confusing and erroneous. It must, however, be some time before full geographical light can be thrown upon this section of the Andean system. It is not less desirable

that we should have fuller descriptions of the coast-valleys and of the Cordilleras between Ayacucho and Arequipa, and accounts of the wholly undescribed country comprised in the Peruvian provinces of Zucanas, Parinacochas, Cangallo, Aymaraes, and Cota-bambas. We shall, no doubt, acquire much additional information from the forthcoming work of Don Antonio Raimondi. At present, however, a great part of Peru, including regions the physical geography of which is specially interesting, is unexplored and undescribed.

Further north, in the Andes of Caxamarca and Quito, we come to a region which has been treated of by the Ulloas and by Humboldt, and to the classic ground where Condamine was the first to measure the arc of a meridian. But even here there are extensive tracts to the eastward of the Cordilleras which need further exploration. When, a few years ago, Wertherman entered the country of the Jivoros, and passed the Pongo de Mauseriche on the Marañon, his journey involved geographical discovery; and the geographical work of Mr. Spruce, whom I employed to collect plants and seeds of the red-bark species of *Chinchona* in the Ecuador forests, was both new and important. There is still much useful work of the same kind to be done in northern Peru and Ecuador, especially in the basins of the Pastasa, Morona, Santiago, Tigre, and Napo.

Next to the Napo comes a great tributary of the Amazon, on its left bank, which, until quite recently, was entirely unknown. This river is the Putumayo, which rises in the eastern Cordillera near Pasto, forms the boundary between Ecuador and Colombia in its upper course, and falls into the Amazon within Brazilian territory. Its great importance as a fluvial highway is obvious, for, if navigable, it would carry the *Chinchona* bark and other valuable products of the Pasto country, direct to the Atlantic.

The exploration of this great river by Mr. Alfred Simson, an enterprising young English traveller, is by far the most valuable contribution to our knowledge of Amazonian geography that has been made for a long time. Mr. Simson's very interesting narrative was printed in the last number of our 'Proceedings.*' The idea of opening this route to the Andes was conceived by some enterprising Colombians who descended the river in a canoe; and Mr. Simson was then intrusted with a steam-launch to ascend the Putumayo from the Amazon, and ascertain its navigability. The

* 'Proceedings of the Royal Geographical Society,' vol. xxi., No. VI., p. 569 (September 19. 1877).

direct distance from the source under the volcano of Pasto to the mouth in the Amazon is 620 miles, and by the windings of the river 1200 miles, the mouth being 1800 miles from the Atlantic, or 3000 miles from the source to the ocean. Mr. Simson describes the currents, the character of the curves and river-banks, and the general features of the stream, with intelligence and care; but unfortunately he was unable to take astronomical observations or to make a survey. This is one out of many examples of the great importance of supplying convenient means for young travellers to acquire these necessary qualifications before leaving England. The subject is a very important one in the interests of sound geography, and is one which might well engage the attention of our Council. Mr. Simson, in the absence of such observations, was a first pioneer discoverer. The course of the Putumayo still awaits exploration by a traveller such as Chandless or Spruce.

Next below the Putumayo, and still on the left bank of the Amazon, comes the great river of Caqueta or Japurá, which rises on the eastern slopes of the Cordilleras of Popayan, and has a still longer course than the Putumayo. Martius ascended it to the falls, and it is frequented by traders. Mr. Bates, however, who is intimately acquainted with the part of the Amazon where the Japurá empties its waters into the main stream, and was long resident at Ega, will be able to tell us to what extent the basin of the Japurá has been properly explored.

On the right bank of the Amazon, between the Yavari and the Purus, around the head-waters of the Jutáy, Juruá, Tefé, and Coari, there is a vast undiscovered region. Mr. Chandless ascended the Juruá for 800 miles; but the Tefé and Coari have never been explored.

Part of Colombia also presents a wide field for discovery. There is an enormous tract bounded on the west by the slopes of the Cordillera, on the east by the Orinoco and Rio Negro: on the north by the River Meta, and on the south by the Uaupes and Japurá, which is practically unknown. This region is also surrounded with a halo of romance, for here the old conquerors of the sixteenth century believed that the far-famed El Dorado dwelt in golden abundance. In 1536 George of Spires set out from Coro in Venezuela, with 400 men, to solve the mystery which enveloped this unknown region. The resolute warriors penetrated into a country which has scarcely ever been visited since, and even reached the banks of the Japurá. A glance at the map will show the immense extent of country which was traversed by George of Spires in this

daring and romantic expedition, which occupied him three years. His lieutenant, Fedreman, marched in a more westerly direction, crossed the Meta, ascended the most difficult part of the Cordillera of Sumapaz, and in April 1539 met the famous conqueror Quesada on the plains of Bogota. Soon afterwards, in 1541, Philip von Hutten, a German follower of George of Spires, led another great expedition from Coro in search of El Dorado. This dauntless commander entered the country which Mr. Wallace, in 1853, called "the unknown regions between the Rio Guaviare on the one side, and the Japurá on the other."

Modern travellers will have to emulate the daring of these searchers for El Dorado, in the re-discovery of the now unknown region. But its exploration is undoubtedly a matter of great geographical interest. Moreover, there are many parts of the Colombian Andes which need further examination. I may mention that I have despatched that admirable collector, Mr. Robert Cross, no less than three times to obtain valuable species of Chinchona plants in the forests of Popayan and the Upper Magdalena, and on every occasion his work has involved more or less of geographical discovery.

In these brief notes I have mainly confined myself to the western half of South America. But there is much exploring work to be done also on the Brazilian side, and in Guiana.

Mr. Spruce ascended the Trombetas, but otherwise the whole region from the Rio Branco to the Atlantic is entirely unknown (a distance of 600 miles), including a dividing range, plains, and forests.

I trust, however, I have said enough to show that there still remains a vast amount of exploration and even of discovery to be achieved in South America, that it is work which is well worthy of the attention of this Society, and that, so far as that continent is concerned, geographers will have no need to sigh because there are no more worlds to conquer, for generations yet to come.

MR. ALEXANDER T. BAILLIE said he had lately visited one of the provinces which bordered on Bolivia—Paraguay; and on listening to Commander Musters' Paper he had been struck by the fact that hardly any mention was made of the communications which were now being carried out, from Bolivia down to Paraguay, and so to the Atlantic. A road was now being made from Corrientes, through the Chaco into Bolivia; and he had met a number of people who were continually passing and repassing between the two countries. That road would afford a means of communication which would take the place of the route to the small port which Bolivia had on the Pacific coast. Commander Musters had reflected severely on the Indian population of the country, but he had forgotten to mention one tribe—the Guaranis—who were very industrious, the women probably more so than the men, and were not very much given to hard drinking.

Mr. E. D. MATHEWS (C.E.) said he was greatly indebted to the Council for the opportunity afforded him of hearing the valuable and instructive Paper by Commander Musters. He was sure that his maps and notes would be of great service in throwing light upon a country which, on account, perhaps, of its inaccessibility, had not hitherto received the notice it deserved. In 1874, being in Bolivia, he had the pleasure of first making acquaintance with Commander Musters and Mr. Minchin; and he had great pleasure in bearing witness to the carefulness with which their observations were taken. There were, however, one or two points in the Paper which he wished to refer to. He did not know if Commander Musters had given the latest boundary between Bolivia and Chili. By a treaty ratified in 1875 Bolivia gave up about a degree of coast-line, and that was a very serious loss. Commander Musters had said that the maritime department of Atacama was an unimportant annex of the Republic; but he thought that statement needed some qualification, for in that department were found the Nitrate Deposits or "Salitreras" of Antofagasta and the famous silver-mines of Caracoles. A good description of the district was found in a book written by Mr. Dingman, and published by Messrs. Trübner, from which he begged leave to quote. The volume devoted to Bolivia opens with an account of the Caracoles Silver Mines, which were discovered in 1870 in the Desert of Atacama, by José Diaz Gana, whose innumerable explorations have been the means of opening an extensive horizon to the capital and industry of Bolivia and Chili. It appears that Diaz Gana, not being satisfied with the result of his explorations on the borders of the desert, sent a part of his company to the interior to explore some mountains where he had reason to believe there would be found some rich veins of ore. Saavedra, Mendez, Porras, and Reyes arrived at the table-land which serves as the base of those beautiful grey mountains. Reyes, having first finished his repast, went climbing up the easy slope, and picked up loose pieces of silver where now are the Merceditas and Deseada Mines, and followed on southward, picking them up in different directions, not knowing their value, but thinking possibly they might be of service. Later on he joined Mendez and the others, who had also found loose pieces of ore, and had made marks in the lead with their knives. Two of them immediately started to the coast to inform their patron. They had been to Diaz Gana what Sancho Mundo was to Columbus. The discovery was made, and that dry and solitary desert a short time after was the centre of an active population. Diaz Gana baptized that emporium of riches "Caracoles," and he was right. The fossils characterising the lias were abundant, and as a matter-of-fact man he fixed upon this notable geological formation to give a name to his discovery. The young Chilean Francisco Bascunan Alvarez is another of those untiring explorers who have helped to convert the desert into a field of labour and industry. After long and laborious explorations in Copiapo, Bolivia, and Catamarca in 1857 he returned to the desert in 1870, and discovered in Caracoles the group called Isla on account of its topographical position. The mines are from 10,000 to 15,000 feet above the level of the sea, and among the richest may be noted the Deseada, Merceditas, Flor del Desierto, Esperanza, San José, and Esmeralda. Then there are the Frederico Errasurig, Sud America, Salvadora, and a host of others, some of great promise, others worth little or nothing. The experiments made by men of science resulted in the encouragement of all kinds of enterprises, and Caracoles soon became an immense field of speculators disposing of large capitals. The merchants of Chili, both native and foreign, were the founders of these companies, the stock of which was sold at fabulous premiums. In Caracoles fortunes were made in a day, and not insignificant ones either, but of millions. But in this, as well as in other pursuits of life, all cannot have the same luck, and thousands went there only to bury their fortunes and their bones also in the vain search for the hidden treasures.

These facts showed that the department of Atacama could scarcely be called an unimportant annex of the Republic. He was glad that Commander Musters had noticed those very remarkable monuments—the “Chulpas.” They had been stated as 10 feet high; but he had seen many two or three times that height. They were built of “adobes” or sun-dried bricks, and had lasted for many hundreds of years. It was therefore to be regretted that something definite was not known of their builders. Whether they were houses or tombs was doubtful. Commander Musters had spoken of the window in the front; but he (Mr. Mathews) thought it was a door, and it was always turned to the rising sun. One tradition said that the builders—whoever they were—at the approach of death caused themselves to be walled-up in those buildings; and gold and silver ornaments and pottery had been found in them. With regard to the fossils of the “Altiplanicie,” he had noticed several, and had picked up one near Cochabamba, 10,000 feet above the sea-level, and he would be happy to add it to Commander Musters’ collection. Referring to the sickness called “Soroche,” he believed it to have been proved that travellers ascending the Andes from the eastern slopes were not so subject to it as those who ascended from the Pacific coast, the reason probably being that the ascent on the east was more gradual. At the Pass of Tacora he himself felt some symptoms of it, although he had come from the eastern side. Against the advice of the native muleteer he took a nip from his flask. The mule-drivers always said that nothing at all must be taken; but the sickness came upon him just about his usual breakfast-time, and he thought it best to fortify himself; the result being that he found no harm at all. One of his mules fell down, and seemed in very great pain; but an old servant of Commander Musters, whom he had with him—a Guacho—very soon had the cargo off, and rubbed garlic into the mule’s nostrils. The remedy was effectual, and very soon the mule was going on again. He did not think Commander Musters had mentioned a natural curiosity, not far from Tacora, where there was a stream very highly impregnated with sulphur. The portion of the track which had been described as covered with bones was called by the appropriate name of “Sepulturas,” or “The Tombs.” For some miles the path was bordered with bones of mules, donkeys, and horses, that had died where they had fallen. The animals were, however, principally cargo-mules, which were very badly fed, and their work was very hard indeed. On this part of the track from the interior to the Pacific Coast, provender is so scarce that each animal’s nightly ration of barley or dried lucerne costs the traveller about 2½ dollars or ten shillings. He was sure the Meeting would join with him in regretting the absence of Colonel Church, the indomitable pioneer of the opening up of Bolivia by the eastern route of the Amazon, who could have given them very valuable information. The Society was, however, in possession of his papers. Perhaps he himself was the only Englishman who had ascended the rapids of the Madeira River. Several had descended them, as had his friend, Mr. Ross, then present; but the ascent was a work of five or six times as much trouble, on account of the time occupied, and the labour of battling with the numerous currents and rapids. Commander Musters said he had been informed that rain fell capriciously all the year round in the plains; but in a small pamphlet (in the Society’s library) which he (Mr. Mathews) wrote in 1875, in the form of a Report on the Rapids of the Madeira, he gave some data as to the rainfall and temperature at San Antonio, the lowermost of the rapids. In the year 1873 about one-fifth of the total rainfall of 91 inches fell in the six dry months, from May 1st to October 31st; while nearly 74 inches fell from November 1st to April 30th, so that there were six dry and six wet months—a division of seasons similar to that of the interior. His journey up the rapids was commenced at San Antonio, on the Madeira, where the railway which is to be constructed round the

rapids will begin. San Antonio could be reached from Europe in 25 days, the navigation up the Amazon to the mouth of the Madeira, about 900 miles, and thence to San Antonio, about 600 miles, being entirely open and free for large steamers. Even in the driest months a steamer drawing 6 to 8 feet could ascend the 1500 miles with a careful pilot. The rapids were 18 in number, and at four of them the canoe must be unloaded and carried round the *portage*. The greatest fall was at the third rapid, called "Theotonio," a fall of about 25 feet, and the total fall in the rapids was about 273 feet in a river-length of 240 miles. The railway would be about 180 miles. It was laid out over an easy line of country, with only one engineering work of consequence in it, and that was where it passed over a river called the Yaci Paraná. The ascent of the rapids occupied him 37 days, and 17 days more brought him to the village of Exaltacion: 10 days further the traveller would arrive at Trinidad, the capital of the highly interesting Department of the Beni. It might be truly said that the highways of that Department were the magnificent riverine canals. When once the traveller had passed the rapids, he needed no further roads. Nature had given the country such splendid canals that nothing better was required. It was peopled by a very docile and intelligent race of Indians, of which there were seven tribes, inhabiting 15 villages. Some of these villages were only 30 or 40 miles apart, but each tribe spoke a different language, so that they could not converse together except through the medium of Spanish, which the more educated had learned. These Indians were a living testimony to the devotion and courage of the Jesuit missionaries of the 16th and 17th centuries. In every village there was a church, and the people were educated as far as they could be; and, apart from the drinking propensities of all Indians, they were a very docile and interesting people. Scattered through the forest there were still a few wild tribes who refused to come near civilisation of any kind whatever. They were, however, not numerous, and were continually migrating. The wildest were called the Sirionos and the Chacobos. Other tribes, such as the Pacaguaras near the rapids and the Yuracarés at the head-waters of the Mamoré, were semi-savage; and with these he had exchanged blankets, &c., for bows and arrows and feather ornaments. The two principal affluents of the Madeira Mr. Markham had so fully noticed that it was unnecessary for him to refer to them, except to mention that a great deal of gold was found in almost all the ravines forming the head-waters of the Beni and Mamoré rivers, and that most of the streams descending to the River Itenez from the Cordillheira Geral in Brazil have auriferous sands. Whilst he was in Sucre a Chilean Expedition returned from the Sierra of St. Simon with very encouraging accounts and specimens of the gold quartz found there. He agreed with Commander Musters that there could be little doubt that Bolivia was the most highly metalliferous country in the world, but he also claimed for it importance as an agricultural region. The road across the Gran Chaco, he thought, could never be made available for any great amount of traffic, because during six or eight months of the year it was perfectly impassable, going through vast swamps. The northern provinces of Brazil would, however, afford a ready market for the agricultural produce, and that industry, if developed, would in a great measure quiet the Republic and prevent the revolutions that were so frequent there, as the financial poverty of the country, which arose from the turbulent spirit of the people, would be removed when they had work to do. The fact mentioned in Commander Musters' Paper, that on the frontier of Chuquisaca, the owner of a magnificent harvest only reaped a small portion of his crop, showed that there was a great opening for trade with Bolivia if proper roads were formed; but any one who glanced at the map must see that it could not be a correct thing to go up a straight wall from the Pacific coast, when there was a broad route eastward, down gently-descending plains, and

thence to the magnificent rivers, the Mamoré, the Madeira, and the Amazon. Descending in an eastward journey from the barren summits of the Andean Passes, the Amazonian route is found to be the natural outlet, not only for the mineral riches of Bolivia, her wools, hides, and other animal products, the cinchona bark (cascarilla), and other drugs, dyes, and commercial values of her unexplored forests, but also for the agricultural riches that already exist in considerable scale on the descending plateaux of her eastern plains. At altitudes of 12,000 feet, barley and potatoes are grown; at 9000 to 6000, corn, potatoes, apples, pears, and all kinds of fruit; at 6000 to 2000, coffee, coca, cocoa, and plantains; and from 2000 to the plains, cocoa, plantains, sugarcane, maize, mandioc, arrowroot, yams, tobacco, and other tropical products. Few, indeed, are the countries that, in addition to the speculative allurements of mineral wealth, can hold forth such substantial inducements to the tiller of the soil; and there is, therefore, no doubt that the character of the people will improve when, through facilities of communication, remunerative work is afforded them, for Bolivians, whether of Indian or Spanish extraction, are very industrious, differing greatly in this respect from the inhabitants of many other countries of South America. The existing import and export trade of the Republic is in the hands of a few English and German houses, and it is hard to get them to leave the grooves in which for so many years past they have been steadily accumulating fortunes. Their trade is mostly carried on through the Peruvian town of Tacna and its seaport of Arica on the Pacific coast. Bolivia found great difficulty in collecting import duties on the land frontier of her neighbour Peru, and therefore entered into a convention with that Republic that commerce between the two countries should be free and unrestricted in consideration of a yearly subsidy of 81,000*l.* from Peru to Bolivia. Taking the year 1873 as a guide, the 'customs' returns of the port of Arica show that the trade of Bolivia afforded to Peru duties to the amount of about 381,000*l.*, so that Peru gained by Bolivian trade about 300,000*l.* per annum in customs' duties at one port. Any extension of commerce on the Pacific side cannot therefore benefit Bolivia, and it appears to be vitally necessary to the Republic that she should open up new routes of trade on her eastern boundaries. Work such as the Meeting has to-night had the pleasure of seeing the results of, will help Bolivia to develop her almost boundless resources, and it may be confidently assumed that Commander Musters will experience great pleasure if his labours should prove the means of attracting attention to a country whose sons, notwithstanding all their faults, cannot fail to be appreciated by all who have travelled through the land.

The PRESIDENT said the conclusions which might be drawn from what had been told them that evening were, first, that the rising generation of geographers need not weep because they had no unexplored regions to discover, for there was abundant scope for all their energies for 50 or 100 years to come; and secondly, that those who had visions of a Malthusian nature might learn that there were vast territories abounding in mineral and agricultural resources, which would accommodate the surplus population of Europe for centuries.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Brief Notice of M. Prejevalsky's recent Journey to Lob-Nor and Tibet, and other Russian Explorations.* By E. DELMAR MORGAN.*

At the meeting of the Russian Geographical Society of the 5th of October, the Secretary, M. Sreznefsky, read a Report received from M. Prejevalsky, of his expedition to Lob-Nor.

Prejevalsky, as we know, returned to Kuldja in the first days of July, and employed his time to the end of August in arranging the collections and materials gathered during his journeys. The scientific results of the expedition hitherto may be summed up as follows:—

1. An itinerary of the route from Kuldja, for a distance of 1200 versts (800 miles), into the interior of Asia.
2. The latitude and longitude of seven points astronomically determined.
3. Barometrical observations for altitude.
4. A series of meteorological observations (taken four times daily).
5. A natural history collection, comprising 3000 specimens, representing 300 kinds of plants; 85 skins of mammalia, 35 of which are of large and medium size; 500 birds, representing 180 different kinds; 50 fish; 150 reptiles; and upwards of 2000 insects. These collections include four wild camels, constituting a scientific rarity.

And, lastly, a journal in detail of the whole of its proceedings.

All the collections were carefully packed and placed in the care of the principal of the Kuldja district, and, in all probability, will be received in the course of the winter by the Museum of the Imperial Academy of Sciences, to be preserved until Prejevalsky's return.

After this brilliant commencement of his journey Prejevalsky rested awhile at Kuldja, and started afresh on his journey to Tibet in the end of August. This second part of the journey of the intrepid explorer is even more dangerous and difficult. Having ascertained for certain the impossibility of entering Tibet from Lob-Nor and the sterile desert which lies beyond the Altyn-tagh, Prejevalsky decided on trying another route, *viâ* the towns of Guchen and Hami, and afterwards taking the direction of Tsaidam and the sources of the Blue River. He hopes to arrive at Lhasa in May or June, 1878, and, after exploring Tibet, he will return to Russia in the autumn of 1879.

The Secretary then communicated the news received from Potanin's expedition. The last letters of this traveller reached the Society about the middle of September. In the first of these, dated the 30th of January, Potanin describes the wintering of the Expedition at Kobdo, and complains of the severity of the climate and the dearth of provisions. Notwithstanding these unfavourable conditions the expedition continued to collect specimens and to pursue ethnological researches. Towards the 15th of March it left Kobdo in two detachments. One of these went direct to Han-chai with the baggage and two hunters, whilst the other, composed of Messrs. Potanin and Rafailof,

* Translated from the 'Journal de St. Pétersbourg.'

took the direction of Hami and Uliassutai. In order to reach the former of these two places the party followed the route taken last year by the Russian merchants of Kobdo. They crossed the Altai-Nouron Mountains,* an eastern prolongation of the Altai, by the Pass of Oulen-daban, near the sources of the Barlyk. The passage across the Gobi Desert occupied two days. South of it lies the Chinese village of Santarou (otherwise called Kara-su). At Barkul the expedition halted some days, without, however, entering the town, although the Chinese authorities offered to find them quarters in it.

The last letters received from Potanin are dated the 25th of July, and refer to his summer journey and his plans for the autumn.

"We arrived at Hami," he writes, "the 16th (28th) May. Here, thanks to a letter from M. Shishmareff, Russian Consul at Urga, we were well received by the Chinese authorities, who found us lodgings in the mercantile quarter of the town. We had several interviews with the Governor. Indeed, most of our time was taken up with official visits. So pressing was the hospitality of the Governor that we had some difficulty in leaving this town. When at length we succeeded in taking our departure we resumed our march by the route from *Kometr-Daban*,† by which we had come, also taken by Sosnofsky; but at the northern entrance of the pass we turned to the east, to follow the northern slope of the *Karlyk-tagh*,‡ an eastern buttress of the Tian-Shan, which is covered with eternal snows. Here we found villages inhabited by the Choutou (Sarpes). At the village of *Nom-Tologoi*† we left the Tian-Shan, taking a northerly direction and recrossing the Desert of Gobi, in order to gain the southern extremity of the *Adjia-Vogdo*,§ a spur of the Altai, rising to the height of the zone of the Alpine flora. We crossed the Altai by the pass of the *Karanuron-Daban*,† situated between the valleys of *Saksa*‡ and *Tsitsiren-gol*.‡ Then, having crossed the parallel chain of *Taimir-ulu*, we arrived at the halting-place of *Djazaktu-khan*.§ On the 13th (25th) July we arrived at Uliassutai."

The expedition collected in the Tian-Shan, the Altai, and at different points of the route. Its herbaria are principally composed of mountain-plants, the flora of the plains which it traversed being extremely scanty. It collected fifty kinds of mountain-plants, mostly from the Altai.

The party proposed making an excursion to the sources of the Yenissei. Towards the end of July it intended leaving Kosso-gol, and taking the direction of Lake Ubsa,|| and reaching Büsk by the Chouia.

Several members of the Society have made scientific journeys in the course of the summer. M. Raïefsky went to Riga to pursue his investigations on

* This chain is marked on Petermann's map in A. Stieler's Hand-atlas as the *Altai-niron*; the pass mentioned in the text is not marked on any of our maps.—M.

† These names are not to be found on any of our maps.—M.

‡ These rivers are not marked on our maps.—M.

§ I find *Chasaktu-ula* as the name of a range of hills faintly marked on Petermann's map; the station mentioned in the text is probably near these mountains.—M.

|| Lake Ubsa lies to the south of the Tannu-ula range, a ramification of the Altai; it was visited by Atkinson, the Siberian traveller, and he describes the appearance of the lake from the summit of one of these mountains. He appears to have gone over some part of the ground traversed by Potanin, and a reference to the map accompanying his work will assist the reader in tracing Potanin's route ('Siberia,' pp. 442 *et seq.*). The Russian traveller Printz visited Kobdo in 1863, on a mission from his government to endeavour to establish direct trading relations with the Chinese who were established there (see *Zapisky*, 'Russ. Geogr. Soc. Gen. Geogr.' vol. i. p. 535).

The town of Büsk, near the confluence of the Obi and Katuna in the government of Tomsk.—M.

the production and trade in corn; Baron Osten-Sacken proceeded to Austria, to continue his ethnographical studies; M. Poliakoff went to the place where a mammoth is said to have been discovered, and then to Lake Balkash. M. Sidoroff succeeded in effecting a daring voyage in his schooner, the *Aurora Borealis*, from the mouth of the Yenissei to the coast of Norway. The ethnographical and anthropological expedition of M. Mainof to the Finnish tribes on the Volga, has furnished new data for geographical science. M. Mainof has brought home an important collection of photographs; he has also made a number of anthropological measurements and observations on the habits of the Mordva.

The Society had contemplated the equipment of another expedition planned last spring, at the instance and with the material assistance of M. Sibiriakoff, charged to explore the water-parting of the rivers Ob and Yenissei. Unfortunately this expedition has not been accomplished, owing to the great preparatory labours which it required. These works, which were undertaken by the Society in conjunction with the Ministry of Ways and Means, could not be finished until the end of June. The Department received permission to take part in the expedition, and it is hoped that it will be ready to start towards the end of winter or in the early spring.

The library of the Society has been enriched during the summer by more than five hundred works. The catalogue is in the press, and half the work will be ready by the end of the year. The Secretary of the Physical Section, M. Lomonosoff, has undertaken the catalogue of the extensive collection of maps owned by the Society. The section *Russica*, which alone comprises two thousand maps, is now ready, and the catalogue will soon be issued. On terminating his Report the Secretary presented an extract of Prejevalsky's Report, which he had compiled at the request of the Council of the Society.

The Vice-President remarked in a few words on the high scientific value of the results of Prejevalsky's expedition, and explained the progress in our knowledge of Central Asia, owing to the labours of M. Prejevalsky, Colonel Sosnofsky, Captain Kuropatkin, and other explorers.

M. P. Semenov at the same time noticed a work on the Aralo-Caspian levelling operations, recently published by Colonel A. de Thilo, and proposed a vote of thanks to M. Thilo for the success which had crowned his labours.

M. Mainof encountered no difficulties whilst engaged in his researches among the Mordva, who are more or less under Russian influence; but this was not the case farther in the country, where he met with an almost hostile reception. M. Mainof took a number of anthropological observations, and his collection of photographs is of especial interest to the ethnologist.

2. *A Tour through Formosa, from South to North.* By ARTHUR CORNER.

I had been staying for a few days in the neighbourhood of the Red Fort Zealandia, at Amping, lat. 23° N. long. 120° 10' E., having come over from Amoy with the idea of travelling into the interior of Formosa in order to see something of the other tribes of aborigines, some of whom I described in a journal of my visit to the south in the early part of the year.

I found the fort a mere heap of ruins, huge masses of masonry, which had formed the bastions and other works of the Dutch engineers, lying heaped around the base of the elevation on which the place was built, and only the large tree standing on it, with some Chinese houses, which form so good a land-mark for vessels approaching this otherwise very monotonous coast. The Chinese were breaking out the bricks from the concreted masses with much difficulty to build a modern earthwork about a mile off under the superintend-

ence of a French engineer, M. Berthault, and it is said they wished to cut down the tree, but it is to be hoped this will be allowed to remain.

The new fort is an ordinary, simple, four-bastioned work, with brick revetments, the parapets being made of mud. The instability of this material, however, appears to have given the constructors some trouble, and it is doubtful whether it will last as long as the old work, which was built by the Dutch in the middle of the 17th century from bricks brought from Batavia.

About half-an-hour's walk inland from Amping along the banks of a creek brings you to the city of Taiwanfoo, after passing a Chinese camp and some suburbs, where a few foreigners have business houses. The walls of the city are in a good state of repair, and enclose a space about six or nine miles round, I was told, although I did not go all the circuit. There appeared to be a large space not built on inside, and containing some very pretty park-like scenery, undulating grassy ground, and large trees. M. Berthault lives in a place like this in rather unpleasant proximity to a powder-magazine.

Just inside the walls is another Dutch fort, brick-built, but rather dilapidated; there was a date over the door which I made out to be 1654. It was here that the crew of a British vessel were confined some years ago, previous to being taken to the execution-ground outside the walls, and, all but one, decapitated by the Chinese authorities. The place is all solid vaulted brick-work, somewhat split in places by the growing roots of the banians, and inhabited only by owls and bats. It stands quite close to the main street, and there are houses up to the walls; I climbed up to the top with some difficulty, and had a good view of the city.

After making some brief preparations for the journey, consisting of the hire of a chair with a couple of bearers to take me to the foot of the hills, about four days' journey in a northerly direction, and the engagement of two burden-bearers to act as guides, I started on the morning of the 15th of February, and, getting clear of the city, passed the execution-ground mentioned before just outside the gate.

I took very little with me, as I meant to travel light—blankets, a few tins of preserved provisions for a change from the Chinese diet, compass, aneroid, and sketch-book, as I intended to walk most of the way, and only took the chair over the flat country at first starting. I looked forward to being away about a fortnight, and in places where the use of a chair would be impracticable. I intended the trip merely as a kind of convalescent ramble through a very interesting country and people.

About 2 p.m. I passed the same broad stream which I crossed further south last year on a bamboo raft. The road led through hedges of screw-pines, mimosa, and euphorbia; there were few birds to be seen, except several varieties of hawks, but the country afterwards became indented with deep dells, which were cultivated, and the water carefully embanked to prevent their being flooded, and about 4.50 I arrived at the village of Hoan a Chan.

Next morning I was away by 7 a.m. and passed the village of Hui Kang-boe at 8. The country was all cultivated, and the people were gathering the pea-straw, the coming crop of sweet potatoes growing up between the furrows of the gathered peas, and I saw fennel growing wild in the heaps. Hereabouts were many more birds: a large black bird with a forked tail was most common, a kind of robin, a thrush which sang the people called a "Tsui coe" (water-fowl), and a small bird like the tailor-bird. At 11.30 we passed Kar Tang-A, where they were gathering ground-nuts, and arrived at E Kar Tang at 12.40. Plantations of sugar-cane were passed at intervals throughout the day, where the land was favourable to its cultivation, and during the afternoon we crossed two streams of considerable size, and arrived at Tsui Kut Than at 2.40. About 4.30 we reached the walled city of Kagee, where

I stayed for the night. Kagee is on the Mandarin-road sketched on the latest Admiralty Chart, and from that point to the place I left it to make the hills no names of villages are put down, the track as on the chart continuing along the low country to the westward in a northerly direction to Tamsui. There is a fine view of the hills to the eastward from the walls of Kagee.

17th. I started about 8, reached Tarniou at 10, and Toa-paw-na at 11.30. All these places which I name are much of the same character, and are called market towns; they consist generally of a long street, with shops under an arcade on either side, with farm produce, fish, and meat exposed for sale, and the street very dirty. We passed through a country cultivated at different levels, with large lakes of water on the higher ones, and carefully-made dams, with outlets unusually wide and well-constructed to provide for the overflow in times of flood. The Chinese are remarkably ingenious in their management of irrigation works, I have noticed, and some of these constructions were very striking. In places where there was a great fall, the floor of the sluice was paved with round stones embedded in cement, in others the banks were preserved by hurdles of split bamboo pegged into the turf and very wide, to prevent the rush of sudden inundations taking effect on the soft ground. The lakes were full of teal, which fluttered along the still surface of the water as the coolies disturbed them. We passed a place called Cho Koo-day, and arrived at Tao Lae at 4 P.M. Here I had to sleep at a Chinese inn, having previously passed the night at Missionary chapels, where you are sure to be comfortable. The native hostelry is simply beastly, and I slept in a place I should really have hesitated to put my horse into. At all these places you can buy food: they give you some stuff they call "thung," a sort of soup with rice, salt, shrimps and ducks' eggs, and you can buy fowls' eggs and chickens, and sometimes goat; but their cooking is defective, and results in repulsion without satisfaction.

I was not sorry to leave Tao Lae on the 18th at 7 A.M., and arrived at Kio Kiong at 9.30. We were now approaching the hills, and entering the first range by a plain between cliffs on either side of the broad and barren ground, formed of sand containing round stones of sandstone and slate of older formation. In the bed of a stream flowing through the wide expanse of river debris my coolies picked up some surface-coal, and it was a likely enough place to find it. At 11 we crossed the principal stream from the high mountains to the eastward, which appeared very grand, and on landing I made a sketch from the raft; and at 12 we reached Lim Kee Pau, where I had to leave my chair behind. I found it useful, although I had walked most of the way. Unless you have a chair of your own specially constructed, these Chinese affairs are very uncomfortable, but they hold your things, and are handy to get in if it rains.

Here I found by my barometer we had ascended about 567 feet above the sea-level, and the plain between the low outside range of hills was becoming narrower and the high ground more precipitous. We again crossed the stream mentioned before, which here assumed the impetuosity of rapids, running under high sandstone cliffs of a more compact formation than those of the lower range, and arrived at Chip Chip at 5 P.M. Chip Chip is in a ravine off the main stream, and is about 707 feet above the sea-level. I tried another Chinese inn here, which was rather worse than Tao Lae.

From Chip Chip at 8 o'clock I again followed the course of the main stream, being joined by some country people going our way, and winding through the plain up the river, which we crossed twice on rafts as it rushed round the base of high sandstone precipices, from which some fine streams of clear water were flowing from caves, contrasting strongly with the water of the river, which was black with fine sand composed of disintegrated slate which was suspended in it. After some time we stopped at a shed at the foot of a

path which led up the hills, and where they sold sugar-cane and other native refreshments, and then began to ascend. We climbed first over hills partially cleared of forest, and passed some Chinese cutting wood, with match-locks placed ready for action in case of savage interference. We got into the forest, and met a party of aborigines who were friendly enough. I do not know whether they belonged to the hostile tribes, but the guides recommended that I should not walk in advance of the party, as there was sometimes some indiscriminate shooting going on here. There is some very beautiful scenery hereabouts as the path winds through the forest, and the magnificent tree-ferns, palms, wild bananas, and climbing-ferns are very luxuriant; some of the latter, with very bold fronds, covering trees some sixty feet high. At the top of one of the passes I found we had attained a height of 2082 feet, and after passing a small plain cultivated with tea-plant, arrived at Tsui Sia, a village on the Dragon Lake, at 2 P.M.

The lake is, I judge, about 3 miles long by 1 broad, its longest diameter being north and south; it is wooded to the water's edge on all sides, and has an outlet on the west side, close to the village I stayed at. The region of the lake is inhabited by a harmless tribe of aborigines, called by the Chinese "Tsui-hoans," or water-men. There is a respectable Chinese house in the place, where I put up, and was very comfortable. I went for a stroll round the banks of the lake, and made some sketches; the stillness of the scene was charming, and the seals were swimming about in all directions. I make the height of the lake 2366 feet above the sea-level, and it is a place anyone, be he sportsman, artist, naturalist, or geographer, might spend a month at.

The "Tsui-hoans" are altogether quiet people, although an indolent and poor spirited lot. They seem to belong to the same race as the other tribes, but contrast with them in want of manly form and intelligence. I had an opportunity of noticing this, as, while I was at Tsui Sia, a party of the inhabitants of the hills came down to the Chinese proprietor of my lodging, on some matters of business, and their appearance was very much the same, and their dress also, as those I had met and drawn at Kao Sia in the south. A number of the southern men were at Taiwanfoo when I was there, and I understood the Chinese were endeavouring to encourage them to become on friendly terms, no doubt with the view of getting the better of them regarding the boundary question.

The Tsui-hoan dress appears to be a series of cotton bags hung round their neck by the corners attached to thongs and laces, and they are altogether "sans culottes," the children being stark naked. The men have a profusion of cornelian necklaces, and a peculiar round ornament resembling the section of a large tooth or tusk; their head-dress is a leather scull-cap with an ornament in front made of the teeth of some animal; their hair is long and waving, and they wore no arms. Some of the boys are large-eyed and handsome, their colour a dusky red. The girls are certainly good-looking, and their dress is similar to the hill tribes in the south, a kind of cotton skirt or petticoat, with a stripe woven in, of native manufacture, a short jacket, only reaching above the breasts with long sleeves, and leggings to the knee, and bare feet. Their hair is parted in the middle, and twisted in with some black cotton stuff, in the shape of a turban, round the head.

Fishing appears to be their means of livelihood, and their canoes are formed of the hollow trunk of a tree, the stern end having a board across, and the bow being stuffed up with mud or turf. As, however, they always sit in the stern to paddle, the bow end is generally out of the water. They work with a single paddle shaped like a spear-head, much in the same way as the Malays in Singapore, and the boats are very similar, only larger. One of the canoes was made in two pieces, very curiously joined together. I think these

canoes are strong confirmatory proofs of the Malayan origin of the Formosan aborigines.

I regretted I had not my sextant with me to determine the position of the lake, which has not been visited by many people, although several claim to have discovered it. It has been said the lake has no outlet; but this is clearly wrong, as we followed the course of the stream on the following day. To the eastward the hills rise very high, and are wooded to the summit of the most lofty, and we are here very near Mount Morrison, and within two days' march of the eastern side of the island, both which I intend to visit on the first opportunity.

The chief difficulty to be overcome would be to secure the services of some savage guides, and the permission of the people to proceed; and this is the reason, apart from the remoteness of the lake, that more people have not visited the place: it is so far out of the main road, and there is always a certain amount of fighting going on with the hill tribes. All the Pe-pau-hoans carry matchlocks and short swords, and are continually under apprehension of some interference. The next day, on my departure northward, we were joined by a party so armed, who accompanied us through the forest.

We started at 8, keeping along the east bank of the lake, and plunging into the woods, sometimes scrambling over hills, and again following the course of a stream over rocks and boulders, among fine trees, camphor and others, from which hung the creepers and long rattans; these latter, in their natural state, having a rough bark like cork. We came upon a pottery, now deserted, consisting of a long brick-built tunnel up the side of the hill, in which they burn the large red earth jars used for water and household purposes. We got out of the woods and our escort returned, and after wading a few streams we came upon the plain of Posia, and arrived at the village at 2 P.M. This village is almost entirely inhabited by professing Christians, and the principal building is the chapel, to which I went. The people were coming out from afternoon service, it being Sunday the 20th, which I had forgotten. The plain of Posia is only 351 feet above the sea-level, and we had been descending very rapidly from the lake. The river runs through a plain to the eastward of the village at a lower level to the great plateau, and both the higher and lower plains are under cultivation, the higher having two villages of Christians, viz., Twa Lam and Go Kum Swa, at each of which there is a large chapel. The people at all these places seem very glad to see foreigners, and you have to run the gauntlet of the whole community, who press to shake hands, and say "Peng Aan," "Peace be with you." Among these poor people and those north I noticed many cases of "goitre." They appear to be mixed with the Chinese, but they have many characteristics of the aboriginal race, although they adopt the Chinese dress. Some people have suggested that the Pe-pau-hoan has some mixture of Dutch blood. How this may be I do not know, but it has not improved their appearance; some of them, the old women especially, being hideous, with low receding foreheads, enormously protruding under-jaw, full of black stumps of teeth, while some had the enormous ape-like long upper lip and receding under-jaw. All the women and children wear a kind of blue bonnet of cotton, very ugly, and their front hair is cut short in a fringe just over their eyes.

On the upper plain there were plantations of hemp (*Boehmeria nivea*) and these extended more or less from this point to Tamsui. Indigo I did not see, as the crops were out of the ground, but I noticed a practice of what is, I believe, considered high farming, viz., that of ploughing a crop of turnips into the ground for manure, and this operation seemed going on in many places. The name "nivea" to the hemp-plant seems very appropriate, when you observe the snowlike effect of a breeze of wind over a field of it, the contrast between the white under and dark upper side of the leaf being very striking.

The weather being rather cold in the evening, most of the old people appeared with little charcoal-stoves enclosed in baskets suspended to the waist under the outside garment; the old women carried this apparatus in front, while the men had it slung in the rear.

The people were engaged in making "Chiu," or distilled rice spirit, and I had an opportunity of seeing something of the process. The still is composed of a cast-iron hemispherical pan of Chinese manufacture, in common use all over the Empire for cooking; this is set over a clay-built furnace, and a tub inverted over it, having a wooden diaphragm with a central aperture, and an inverted cast-iron pan fastened in the interior. The whole is luted together when the still is charged, and as the steam from the mash rises through the hole in the diaphragm to the dome of the upper pan, it is condensed there by water applied above, and the condensed liquid runs down on to the diaphragm, which is placed slightly obliquely in the tub, and passes out through a small bamboo inserted in a hole in one of the staves. The mash is made of boiled and fermented rice, and it is said that the fermentation is assisted by the admixture of rice previously masticated by the old women, and that young women employed in this operation do not answer so well. There is, I believe, in human saliva some principle which promotes decomposition or fermentation, and it is quite probable the Chinese availed themselves of this nasty discovery to facilitate the process of wine-making. The liquor is of a light pinkish colour, with a hot alcoholic taste, and about as strong as bad sherry.

On the 21st I started again to get out of the plain of Posia, intending to reach Chao E Tun that evening, a distance of 50 li, according to Chinese measurement about 17 miles, but to my mind about 25, and this journey was about the most severe day's walking I had. Descending from the upper plain, which is only partially cultivated, and somewhat arid and sandy, we pursued the course of the stream in the lower plain which, winding under high banks to the northward, flows through the forest into which we plunged, and through which we were toiling the whole day. During our passage through the hills which separate Posia from the western plains, we ascended to a height of 2177 feet through very thick forest, and here the rattans, ferns, and orchids were growing very luxuriantly. I secured two specimens of the latter, which I have brought to Amoy alive, and I am endeavouring to get them into flower during the approaching summer, in hopes of their turning out something new to the botanical world. I killed a beautiful emerald-green water-snake in the forest. After emerging from the forest we came upon a broad plain with high sandstone cliffs, on which the stratification was very marked, and the jagged outline of the distant hills formed a capital land-mark. We reached Chao E Tun at 6-30, and went to a Chinese inn, which did not look very inviting, and induced me to search through the town for more convenient lodgings, but not being able to speak a word of the language, this business was somewhat embarrassing. The people at the inn were lying about smoking opium, and the place proposed for my occupation was a kind of loft open to the weather, and very dirty. In a tobacco-shop I met a respectable-looking man, who invited me to his house, where I was conducted to a similar kind of loft over the shop, where opium smoking in a domestic way was also being conducted, so that altogether I did not profit much by leaving the inn.

Next morning, 23rd, I was marching by 7-30 in a north-westerly direction, and at noon reached Ta-veh Ket, and arrived at Toa Sia at 4 P.M., having passed villages and farms all the way, and the farm people engaged in planting paddy in the extensive plains we traversed. There is a fine view of Mount Sylvia from here to the eastward, and a fine rapid stream of water

flows past the village which serves to turn a primitive water-mill for stamping rice.

I did not leave Toa Sia until 2 P.M. next day, and after crossing the valleys of the two streams running west, arrived at Sai Sia at 6 P.M., having kept a northerly course all day. During the walk I passed several tea-plantations, and also some fields of poppies for opium, extensively cultivated on the mainland. The plants I saw were not the black poppy, but variously coloured, red, purple, &c., and apparently very healthy plants.

The walking in the river plains, which we seemed to be traversing all day, was very bad, being over sand and boulders, and round stones about the size of your head, of slate or sandstone, and crossing streams, which I did on the bearers' backs, and then more round stones; you have to skip from one to another, which in nailed boots is dangerous and tiring, when there are miles of the same sort of ground to get over. From the cliff of the second river plain there is a fine view of the valley, which is under cultivation for rice. I now began to feel the effect of the change in temperature from passing out of the hills, and meeting the north-east monsoon, the climate in the forests being comparatively warm. I could have wished the season to have been different, as the orchids would have been in flower, and many objects in the forest more attractive. As it was, there were but few blossoms to be seen; wild raspberry, guava, violets, mimosa, and an arum or two were the only flowers we saw.

My two guides live at Sai Sia, which is a small place in a valley on the north bank of the second river-plain we passed since leaving Toa Sia. This place is peculiar, from being very much shut in by surrounding cliffs, and the small Christian settlement are under continual dread of savage invasion. I understand it is in contemplation to abandon the place, and make a kind of exodus of Pe-pau-hoan Christianity to the head-centre at Posia. My two guides have large families here, and are deacons of the Church. I have heard of being priest-ridden, but fancy riding on a deacon's back, as I did through all the streams! Kar Pow, one of them, was a cheerful sort of fellow and most useful, and although I could not speak Chinese would understand what was wanted, and saved me often from that resource of travellers, viz., doing a thing yourself. The other man, A Tou Wye, was a morose, desponding sort of fellow, but a good walker. I found them both, as my only companions, very useful; but I regretted my want of the language, which prevented me from gaining information beyond ordinary observations. I had a book of the Amoy dialect, which is very good in its way, but the patois spoken here differs in so many ways that I found it rather tedious than otherwise to use it, and trying to the temper.

I left Sai Sia on the 25th at 9 A.M., and after climbing out of the valley commenced walking over the hills, which had been cleared of forest, and was strewn with stumps of camphor-trees and charred underwood. The young fern was growing through the burnt grass, and there was a fine breeze blowing in our faces, and after passing over the downs we traversed a beautiful valley and reached the banks of a river-bed with high cliffs looking down on the town of Bar-ne-keh, a place inhabited by Hakkalis. These people are a sort of gipsy race distributed over the continent, and especially the south, by Canton. At Bar-ne-keh I bought a large leopard-skin—there are some very handsome animals of this description in the country. After walking over the plain through paddy fields for some distance we reached Sin Kong at 6 P.M. This place is much nearer the sea than I imagined I was, the weather having been misty during the day, and I was surprised to have some fresh fish served up for dinner. Sin Kong is laid down on the Admiralty Chart, and I had now got on to the Mandarin road again, which I had quitted at Kagee city.

I had some difficulty in getting away from Sin Kong, owing to my being

footsore, and being desirous of obtaining a chair and bearers for the next stage. It now began to rain, but I was determined to proceed, so started on foot, as I could not get a chair, at 10, and crossing some sand-hills, in face of a driving rain, we reached a ferry across the mouth of a river with a bar, inside which some junks were anchored, and crossing came to a considerable town the name of which I forgot to note. Here I got a chair to Teuk Cham, and as the rain was very heavy the whole way since noon, when I chartered the chair, until 6 P.M., when I got to the inn, I did not see much of the country.

27th.—I started at 8 A.M., taking on the chair as it was raining heavily. The country was mostly flat, with low ranges of downs. We crossed a river by a ferry guided by a long rattan stretched across the river without a splice; it was the longest rattan I have seen, and I should be afraid to estimate the length. The country was under cultivation for paddy, and the young plants were growing in beds, protected from the north wind by screens of reeds. These I first noticed in Sai Sia. They were ploughing in the turnip for manure about here. We reached Tieng Liek at 4 P.M., and as it had been raining all day the inn was welcome enough.

On the morning of the 28th I started from Tieng Liek at 7 A.M., and, as the rain had given over, walked the first stage. The ground, however, was very slippery and unpleasant, and walking not altogether desirable through the paddy fields. We reached Toa Hung at 9:30 A.M., and as the rain continued to hold off pressed on until about 4 P.M. I was not sorry to see the white houses and green verandahs of the foreign settlement of Toa Tu Tia. A broad river flowed between, which we crossed in a ferry-boat, and I soon found acquaintances and quarters, and some one to talk to after thirteen days of comparative silence. Toa Tu Tia is the residence of the mercantile agencies for the purchase of tea in the north of Formosa. Banka is the Chinese business town, a mile or two up the river, on the same bank as Toa Tu Tia, and Ho Bay is the shipping port at the embouchure of the river of Tamsui, where reside the British Consul and Chinese Customs authorities. There is a steam launch belonging to a firm there interested in the shipping trade, which plies between Toa Tu Tia and Ho Bay, and does the trip in an hour or two as the tide serves.

Between the latter places, and not very far from the river, are some sulphur springs, where the gas issues from the earth in a very remarkable manner, and will well repay a visit.

The route to Keelung, either by water or road, is most interesting. Here are extensive deposits of coal, and the Chinese authorities have wisely determined to work the mines on European principles, and are about to procure proper machinery for that purpose. I feel convinced, from the ground I traversed, there is more coal in Formosa than what is already discovered and worked, but about other minerals I am not so certain. If I have another opportunity I shall certainly try to go to Chok-e-Day from Posia, and under savage guidance may see more of the vegetable and mineral wealth of the island, which has as yet been very imperfectly explored.

Amoy, November 26th, 1876.

Since my last communication I found myself again in Formosa, and again visited by a different route the Lake and Posia, approaching from the north. I intended travelling down the East Coast, and passing through the savage territory from Chok-e-Day to Posia, but found it impracticable, and with much regret had to relinquish the idea. It seems extraordinary that so small an island, some 30 or 40 miles of country in savage occupation, should offer so many obstacles to exploration, but the difficulty lies in the jealousy of the people themselves. If you made friends with the tribe near Posia for instance,

and got guides to the extremity of their ground, the next tribe would regard you as an enemy, and hold no intercourse with you at all. There are not many Chinese or Pepauhoans who understand the savage dialect, which differs very much in parts of the island; communication takes place through the women in many cases, but it would be impossible to induce a Chinese or Pepauhoan to accompany you as an interpreter into the savage district.

On the latest Admiralty Chart there is a place marked *Tau si Kak*, a little distance from the coast, on the north-west side of the island. It is situated on the north bank of a broad river, and is, I should say, much farther inland than laid down in the chart. The savages visit this place to trade, as well as another place about four hours to the north called *Talan*. The tribe about here are very troublesome to some of their neighbours, and the plague of the *Lek-hoan* at *Sai-sui*, which is on the same river as *Talan*, but farther down some two hours' walk. The men of this people are certainly handsome, but short made, with large hands and feet. They carry the usual sword and matchlock, and are peculiar for extracting the two front teeth on either side of the central incisors of the upper jaw; they wear a linen coat open in front, and a sort of cloak, but only a narrow strip of some embroidery round their loins, which does not answer the purposes of decency.

From this region I passed on to *Toa Sia*, about four hours' walk, and from *Toa Sia* I proceeded to *Posia* by a different route to that I used when last here. I passed very soon into the hills, and walked two days without leaving the forest, spending one night on the ground after fording a very broad and rapid stream, which I passed coming up at *Chow E Tun*, but of course much farther to the westward. I send you a sketch of the plain of *Posia* from bearings which I took, and at a small lake on the plain I was enabled to take observations of the position of the place with my sextant, and I make it in latitude $23^{\circ} 46' \text{ N.}$, and longitude about $121^{\circ} 03' \text{ E.}$ I will send the sketch by English mail, also a section of the island at about this point. From this plain there is visible a mountain of considerable height, whence the sea can be seen on the east side, and the whole distance cannot be more than 27 miles or thereabouts.

From *Posia* I went to the lake and got the position of that, which I place in latitude $23^{\circ} 32' \text{ N.}$; longitude $120^{\circ} 53'.$ I also send a sketch of the lake from bearings taken.

I now beg to offer some remarks on the Physical Geography of the island.

In *Kelung Harbour*, in the north of the island, facing the north-east, the following observations were made in the course of a year. (See Table on p. 62.) From which figures we learn that during the south-west monsoon the barometer ranges lower, and the average rainfall is smaller, at the same time the difference in the maximum and minimum temperature is greater. On the other hand, in the north-east monsoon the barometrical indications are higher, the rainfall greater, and the temperature more even and cooler.

During the summer the winds in the immediate neighbourhood are local, and influenced by the high range of hills between *Kelung* and the direction from whence the wind comes. It seems probable that the heated currents of the Japan stream load the air with moisture, which is condensed by the cool currents of air from the northward. The Japan stream is merely a continuation of the equatorial current, caused by the diurnal motion of the earth, and falling against the continent of Asia on the eastern side is deflected to the north, the same as the Gulf Stream is against the coast of America. *Formosa* is so situated that it is particularly under the influence of rain-bearing winds, and the northern part especially is very much subject to the effects of condensation of aqueous air. Next mail I will send some further observations on the meteorology of the island, which for want of time I cannot do now.

KELUNG.

	Barometer.	Rainfall.	Thermometer.			
			Max.	Diff.	Min.	
	Mean.	Inches.				
January ..	30·19	16·68	62·40	9·01	53·39	North-East Monsoon.
February ..	30·11	14·39	62·99	8·29	54·90	
March ..	30·03	12·93	65·08	8·93	56·15	
April	29·98	8·62	71·87	10·90	60·97	
May	29·70	16·59	79·80	11·38	68·42	South-West Monsoon.
June	29·71	4·37	86·99	12·27	74·72	
July	29·60	3·62	88·11	12·19	75·92	
August ..	29·62	8·63	87·40	10·41	76·99	
September	29·71	8·20	87·22	10·05	77·17	North-East Monsoon.
October ..	29·92	6·62	79·78	8·55	71·23	
November ..	30·15	6·58	70·00	8·12	61·88	
December ..	30·13	11·42	68·77	9·01	59·76	

Amoy, December 5th, 1876.

TAKAO.

	Barometer.			Thermometer.			
	Max.	Min.	Range.	Max.	Min.	Range.	
January ..	30·23	29·94	29	79	55	24	North-East Monsoon.
February ..	30·22	30·11	11	81	56	24	
March ..	30·26	29·98	28	83	55	28	
April ..	30·18	29·89	29	84	66	18	
May	30·17	29·88	29	89	72	17	South-West Monsoon.
June	30·07	29·84	23	86	79	7	
July	30·08	29·49	59	91	77	14	
August ..	30·01	29·50	51	89	77	12	
September ..	30·06	29·79	27	87	80	7	North-East Monsoon.
October ..	30·25	29·90	35	86	71	15	
November ..	30·30	30·05	25	84	60	24	
December ..	30·32	29·96	36	82	63	20	

The above tables show the highest barometer and the lowest ranges as occurring during the north-east monsoon, together with the lowest temperature and highest ranges of the thermometer. On the other hand, during the

months when the southerly winds prevail, the barometer is lower and the range greater, probably owing to passing typhoons, which, however, in this year above noted do not seem to have caused very low readings of the glass. The variations of temperature also are less. It has been found that a register of the readings of wind-gauges in the north of the island did not work satisfactorily, on account of local causes, and in the south I have not been able to obtain any regular observations; the prevailing winds, however, are the monsoons, and the direction of the great current of air, moving over the island at any given season, is only altered locally by such phenomena as typhoons or by the presence of high hills.

During the north-east monsoon the north and west coast is most subject to rain, and at the change of the monsoon the plains on the westward side seem to get more of it. Takao, however, does not get nearly so much rain as Tamsui, which enjoys an abundant rainfall, which the European inhabitants do not enjoy. As seafaring people say, the country under the lee of the mountain ranges, when either monsoon blows, is not subject to rain, although the hills themselves may be covered with vapour.

3. *Probable Occultation of Stars by the Moon in Eastern Africa.*

STARS that may be occulted by the MOON in EASTERN AFRICA, between 3° N. and 15° S. in 1878 and 1879.

(Compiled under the direction of Professor J. R. HIND, Superintendent of the Nautical Almanac Office.

Date.	STAR'S NAME.	Magni- tude.	Greenwich Mean Conjunction in Right Ascension of ☾ and *.		At Conjunction in Right Ascension.		Apparent Declination of ☾ and *.	Difference of Apparent Declination of ☾ and *	Limits of Latitude.
			H. M. S.	H. M. S.	Apparent Right Ascension of ☾ and *.	☾			
1878.									
Jan. 27	α Scorpii ..	1½	14 18 19	16 21 56.00	S. 26° 9' 40.2	S. 31° 53'	8° S. 84° S.		
Feb. 12	β Tauri ..	2	6 49 13	5 18 36.82	N. 28° 30' 19.0	S. 42° 51'	1° N. 61° S.		
" 14	α Geminorum ..	3½	12 14 1	7 37 7.42	N. 24° 41' 20.5	S. 23° 14'	22° N. 48° S.		
" 18	ν Leonis ..	4½	13 58 15	11 30 44.36	S. 0° 9' 14.8	N. 21° 41'	64° N. 26° S.		
Mar. 25	φ Sagittarii ..	3½	11 38 19	18 38 3.60	S. 27° 6' 55.7	N. 24° 0'	44° N. 19° S.		
April 10	κ Geminorum ..	3½	5 31 9	7 37 6.68	N. 24° 41' 22.6	S. 39° 13'	6° N. 65° S.		
" 14	ν Leonis ..	4½	11 55 11	11 30 44.62	S. 0° 9' 17.7	N. 18° 47'	61° N. 28° S.		
" 19	α Scorpii ..	1½	13 32 33	16 21 58.61	S. 26° 9' 46.5	S. 14° 10'	9° N. 58° S.		
" 24	θ Capricorni ..	4	12 37 11	20 59 6.84	S. 17° 42' 57.8	S. 3° 49'	32° N. 47° S.		
May 16	π Scorpii ..	3	11 51 11	15 51 31.88	S. 25° 45' 55.9	N. 36° 56'	60° N. 8° S.		
" 19	σ Sagittarii ..	2½	9 7 7	18 47 45.33	S. 26° 26' 47.8	N. 29° 18'	51° N. 11° S.		
" 21	♃ Jupiter ..	..	10 44 15	20 38 38.97	S. 18° 55' 21.7	S. 23° 49'	11° N. 70° S.	
June 13	α Scorpii ..	1½	8 37 46	16 21 59.56	S. 26° 9' 49.0	S. 7° 30'	14° N. 51° S.		
July 5	ν Leonis ..	4½	7 58 23	11 30 43.96	S. 0° 9' 14.0	S. 20° 3'	26° N. 62° S.		
" 15	θ Capricorni ..	4	13 52 5	20 59 9.27	S. 17° 42' 46.9	N. 29° 59'	63° N. 11° S.		
" 21	η Piscium ..	3½	15 13 27	1 25 0.01	N. 14° 43' 15.0	S. 23° 38'	20° N. 62° S.		
Aug. 6	π Scorpii ..	3	9 0 44	15 51 31.87	S. 25° 45' 57.7	N. 26° 10'	49° N. 18° S.		
" 9	σ Sagittarii ..	2½	8 51 31	18 47 46.51	S. 26° 26' 47.8	N. 34° 56'	58° N. 8° S.		
Sept. 30	σ Scorpii ..	3½	7 18 47	16 13 49.15	S. 25° 18' 8.0	S. 37° 45'	12° S. 90° S.		
Oct. 5	θ Capricorni ..	4	8 57 32	20 59 9.38	S. 17° 42' 47.0	N. 40° 5'	73° N. 3° S.		
" 11	η Piscium ..	3½	11 2 18	1 25 1.82	N. 14° 43' 27.5	S. 34° 41'	9° N. 74° S.		
" 19	δ Cancri ..	4	15 12 39	8 37 48.42	N. 18° 35' 56.9	N. 11° 39'	54° N. 23° S.		
Nov. 3	θ Aquarii ..	4½	4 56 33	22 10 27.55	S. 8° 23' 5.0	S. 49° 50'	8° S. 90° S.		
" 28	♃ Jupiter	8 5 10	20 25 6.05	S. 19° 58' 18.8	N. 31° 13'	64° N. 13° S.		
Dec. 16	ν Leonis ..	4½	12 43 13	11 30 45.92	S. 0° 9' 24.6	S. 56° 37'	9° S. 90° S.		

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The Conjunction being given in Greenwich Mean Time, the longitude in time must be added for local time in Eastern Africa.

PROCEEDINGS
OF
THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED MARCH 27TH, 1878.]

SESSION 1877-78.

Third Meeting, Tuesday, 10th December, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*Rev. William Baker, B.A. ; George Deudney, Esq., B.A. ; Jno. Sanford Dyason, Esq., F.M.S. ; T. H. S. Escott, Esq. ; Thomas Matthew Gisborne, Esq. ; Edward Hight, Esq. ; Lieut.-Colonel Gustavus Hume (Exon Royal Body Guard) ; Walter Knight James, Esq. ; William M. Macdonald, Esq. ; John Elliott Mills, Esq. ; William Lucas Shadwell, Esq. ; Rev. Samuel Walter Stott, B.A. ; Edward Wadham, Esq., J.P. ; Joseph King, Esq.*

DONATIONS TO LIBRARY, 26TH NOVEMBER TO 10TH DECEMBER, 1877.—Notes on a voyage to the Arctic seas in 1863, by Thos. Tate ; Alnwick, 1864 (*Professor Rupert Jones*). Catalogue of charts and books published by the U. S. Hydrographic Office, 1876, and Lists of lights, 1-6, Nos. 30-336, 1877 (*The Office, per Commodore Wyman*). Africa Pilot, part 2, 1875 (*Lords Commissioners of the Admiralty*). The Country of the Moors, by E. Rae, 1877 (*Author*). Catalogue of the Educational division of the S. K. Museum, 1876 ; Catalogue of objects of Indian Art in the S. K. Museum, by H. H. Cole, 1874 ; Catalogue of Persian objects in the S. K. Museum, 1876 ; Description of the Trajan Column, by J. H. Pollen, 1874 ; Persian Art, by R. M. Smith, 1876 ; and Monuments of Early Christian Art, by J. W. Appell, 1872 (*The Committee of Council on Education, South Kensington Museum*). Ninth Annual Report of the U. S. Geological and Geographical Survey of the Territories, for 1875, by F. V. Hayden ; Washington, 1877 (*Dr. Hayden*). Annual Report of the

Board of Regents of the Smithsonian Institution for 1876 (*The Institution*). The Russian Bugbear, by J. Long (*Author*). Ueber die Lage der Schneegränze und die Gletscher der Gegenwart im Kaukasus, von H. Abich; St. Petersburg, 1877 (*Author*). The Fishes of India, by F. Day, vol. i., 1876 (*Author, per Mr. Quaritch*). Report on Mysore Census of 1871, and Supplement, by A. W. C. Lindsay; on Census of Bombay Presidency, 1872, part iv., Punjab, 1868, the Island of Bombay, 1864, British Burma, 1872, Ajmere and Mhairwarra, 1877, and Oudh (2 vols. by J. C. Williams), 1869 (*H. M. Sec. of State for India*). Stanford's Compendium of Geography and Travel: Africa, edited by Keith Johnston, 1878 (*Mr. Stanford*). And the current issue of publications of Corresponding Societies, Periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM NOVEMBER 26TH TO DECEMBER 10TH, 1877.—Outline Map of the Transkeian Territory (S. W. Silver, Esq.). The Country of the Wabondei, Was-ambara, and Wakalindi (Universities Mission). 1 Sheet MS. tracing by J. B. Minchin of Mappa-Nuevo de la Republica Boliviana (Comr. Musters, R.N.).

The following Lecture was read by the Author:—

On the Formation of the Main Land-Masses. By Professor P. MARTIN DUNCAN, M.B. Lond., F.R.S., President of the Geological Society, Correspondent of the Academy of Sciences, Philadelphia.

SOME years since, a very suggestive sentence was frequently spoken by a great man, whose memory is very dear to this Society as well as to that over which I have the honour to preside.

The words were "Being a geologist I am an ancient geographer," and the man was Murchison.

This short phrase enunciated his belief in the sisterhood of the sciences of Geography and Geology, and it may be taken to affirm his opinion regarding comparative uniformity in nature, and of the continuous operation of the same causes in the gradual development of the earth. The well-remembered words not only bind the present and the past in a great philosophy, but they may be inferred to protest against the assertion that the face of nature has been unchanged, and that the great features—the study of the geographer, the delight of the traveller, the charm of the artist and the contention of races—were formed at once and are without any relation to a distant past.

The opinions and theories involved in this brief sentence of Murchison's, were common to most educated geologists many years

ago ; and it was very generally held that the world had had a particular geography or special surface characteristic during every consecutive chapter of its history. Advanced thinkers held, that as the present aspect of nature on the globe was foreshadowed in the past, so each consecutive mutation of the surface was evolved in the womb of time, and retained impressions of its ancestry.

Lyell, following his great master Hutton, insisted on there being a close connection between geographical and geological science. He defined his favourite branch of knowledge, as follows : "Geology is the science which investigates the successive changes that have taken place in the organic and inorganic kingdoms of nature ; it inquires into the causes of these changes, and the influence which they have exerted in modifying the surface and external structure of the planet." Hutton, writing a century since, inculcated the theory of former, slow, progressive changes of the surface of the earth under the influence of the same agents which produce changes at the present time. He taught that geographical knowledge, in its widest sense, must precede geological study ; and that the two sciences were so bound up under the reign of continuity and uniformity that the modern example could illustrate the occurrences and vicissitudes of the past. Moreover, he wrote : "The ruins of an older world are visible in the present structure of our planet, and the strata which now compose our continents have been once beneath the sea, and were formed out of the waste of pre-existing continents. The same forces are still destroying, by chemical decomposition or mechanical violence, even the hardest rocks, and transporting the materials to the sea, where they are spread out and form strata analogous to those of more ancient date. Although loosely deposited along the bottom of the ocean, they become afterwards altered and consolidated by volcanic heat, and then reared up, fractured and contorted."

From the days of Hutton, downwards through the erratic phases of geological thought, which have vainly attempted to establish a mechanical hypothesis of repeated destructions and miraculous renovations of the surface of the habitable globe, there has been a clear scientific light, shining through the intelligence of the great teachers of advanced geology, which has relieved the dull monotony of Geography as a purely descriptive art, has elevated it to its proper position in natural science, and has environed it, as the outcome of the past, with a philosophic causation. Moreover Geography, defined as the science which investigates and describes the existing aspect of nature on the globe, has afforded a sure basis of argument to the geologist, who is enabled, by the

analogy of the present, to restore the former lands and seas ideally, to state their ancient limits and to re-establish their faunas and floras, from the material relics he may have collected or noticed. In fact, to use Murchison's expression, "the geologist is an ancient geographer:" and his highest aspirations are to be able to restore the animate and inanimate nature of each of the chapters of the great book of nature, and to prove that the great land-masses are the sum of all the geological changes of the past, within and without the earth.

The more the interdependence of the two sciences is noticed, and the interactions of the one as an exemplar and of the other as a history of events are studied, the more readily can it be understood that some parts of the world have been subject to many changes, whilst others have been comparatively quiescent. And that whilst some restorations of ancient scenery and geography, on scientific principles, will follow a law of progression towards the present aspect of nature, on the same spot, others of very old lands, may take an existing example observable in very remote countries, as their type.

Thus, in familiar language, the north-west of the globe has suffered greater geological change than regions to the south-east; and whilst some consecutive geographies arose, culminated and gave place to others in Europe, there was a sameness of landscape and of physical conditions in large tracts of Africa, Hindostan and Australia.

In considering the structure of the oldest known sedimentary strata, of which continents are composed, rolled pebbles come to view low down in the series, and, according to the teaching of existing nature close at hand, they must have been worn by the action of running water from pre-existing land. Thus, in the first chapter of the history of the accumulation of the great land-masses of the northern hemisphere, the analogy of the present brings an old sea beach, with its rolling stone and land close by, before the restorer of the remote past. Again, some strata in Europe of Jurassic age, contain the fossilised remains of plants and of portions of the crania of animals; and when the test of modern comparison is used, an Australian landscape affords the example. There the same animal and vegetable groups, only differing in genera, are to be seen as of old, and it is even possible to find them living on and in the strata which were deposited more or less synchronously with those which contain their fossilised representatives and perhaps progenitors in the northern antipodes.

The modern example, the gift of geographical science, tested

throughout the history of the accumulation of strata noticed by Hutton, and well studied in most parts of the great land-masses by his successors, does not fail in explanation of geological facts. But the causes of the successive chapters of the Stone book, with their gradually changing geographies, and the reason why the ocean-floor and the great land-masses of some parts of the world, altered in their relative level more frequently than in other areas, are not perfectly explained by reference to those slight changes in the distribution of land and sea which come within the cognisance of the geographer. Upheaval of the land to the extent of thousands of feet can be shown to have taken place, over and over again, by the simplest process of reasoning from the modern example and its reference to the method of accumulation of sediments. On the other hand the positive proofs of modern subsidence are slight; they become stronger, inferentially, in the chapters of the world's history which precede the present; and in remote ages, as well as in the later, the inference and the absolute proof of the existence of old land-surfaces, beneath thousands of feet of marine deposits, are as valuable in the argument as the evidence of an eye-witness. The causes of these great movements of the surface of the globe, and of their differing in extent, rapidity, and in frequency of occurrence—even were the study of the internal physical condition of the globe within the scope of the geographer—could not receive very satisfactory explanation by direct reference to the existing state of things. But it is possible to infer the former state of the globe, from the slight knowledge gained of late years concerning the deeply-seated masses of the earth, and by applying to it the theories of thermo-dynamics under the law of the conservation of energy. Motion of the surface of the globe is thus explicable; but, in extent and frequency, it bore but slight resemblance to the modern examples, although the causation must have been the same.

It would appear that whilst it is within the province of the geographer and the geologist to study and examine the great land-masses as they now are—the one as a describer and exemplar and the other as a historian and restorer—the subject of causation belongs to other sciences. Nevertheless, the geographer has a right to be as eclectic as the geologist, and may insist upon the application of any reliable theory to the existing state of things on the earth.

Assuming Hutton's statement of the building-up of continents, with the exception of the reference to volcanic action, to be, in the main, correct, the method of explaining the past from the modern example may be applied in illustration of the formation

of the great land-masses. And, finally, the causation, derived from the astronomer and physicist, binds the subject before us, in a singular history, where uniformity, variety, stability, and cyclical change occur in inanimate nature, in association with the progressive and endless variety of the animate kingdoms, in which there is no recurrence.

The Continents and their great Features.—Europe, Asia, Africa, the Americas, and Australia, the great land-masses of this late chapter in the World's History, situated mainly in the northern hemisphere, slope up irregularly, but on the whole from great ocean-depths; and, as a general statement, it is true that they have high land along the coast, or at a short distance from it. Without there being absolute parallelism, the main mountain axes and chains are at the sides of continents; and great river-valleys, or rather hydrographical basins, with or without table-lands, as a rule, occupy their midst. The exceptions to this position of mountains are either accompanied by a remarkable parallelism of distant chains, or they are found in regions where enormous denudation has occurred, or where the insular condition is being brought about. But even in the instance of the vast mountain-chains of the Himalayas, of the Caucasus, the Alps, and Pyrenees, all more or less united in a great orographical system, they are included in the vast continent whose eastern side, from Behring's Straits to Siam, has a series of mountain-systems not very remote from the coast, and whose western limits are marked by the Scandinavian hills, with which those of Scotland, Wales, Ireland, and Portugal are in orographical continuation. And their especial parallelism is with the mountains of Central Asia, and with those which extend more or less continuously from Barbary eastwards.

The anomalous north and south Ural chain, forming an artificial separation between the European and Asiatic portions of one great land-surface, is not without its parallelism with the distant coast-ranges.

More or less elevated at the sides, to the east and west especially, and parallel to the longest development of the Atlantic and Pacific Oceans, the longitudinally situated continents slope in different directions. The principal slope, tested by the length and direction of the main river-systems, is from east to west in Equatorial Africa, and from west to east in South America. In North America the northern pitch is from west to east, and the southern from north to south; the reverse being the case in North-Eastern Africa.

In Australia, the mountains on the east and south-east, and on the west, limit a central land of vast general level; and in the

great northern continent, the central east to west mountain-systems render the slope more or less radiating. The slope is, of course, from the highest part of the land-surface.

Considered in relation to the floor of the ocean, much of the African, part of the European and South American, and much of the North American slope is towards the long Atlantic floor, whose sparsely-distributed oceanic islands testify to its stability. On the contrary, the highest areas of the American and African continents are not remote from the Pacific sea-floor and that of the Indian Ocean respectively, which are areas of subsidence. Again, in considering the great features of the continents or their parts, South America, Africa, Hindostan and South-Eastern Australia, point off to the south towards the watery half of the globe. The cause of this is not simple current action. The coast mountain-line of South Africa turns round the broad southern extremity, and is immensely old; and the shape of the south of the continent is mainly due to the direction of the axis of the range. But Madagascar, situated to the east of that part of the continent where the tapering-off begins to be evident, has a semi-continental mountain-system parallel with the long axis or strike of the coast-range of the mainland. It was a part of the African continental system, and has been separated by subsidence. The tapering of South-Eastern Australia is evident, but the Australian Alps turn to the west parallel with the coast. In order to comprehend the original condition which preceded the present, the parallelism of New Zealand and its axial mountain-chain, with the eastern coast-range of Australia must be considered. It indicates a former extension of the great insular continent to the east and south. Probably subsidence of the coast-line has produced the South Australian thinning off more than coast waves. Hindostan is bounded on the sea-coast to the west to within 300 miles of the south by a great fault or subsidence, by which the west of the Deccan trap, a great volcanic mass, has been let down bodily. On the east are the mountains of the Carnatic; they turn slightly, as they approach the south, towards the west, and merge into the Nilgherry Hills, forming with them a broken curve inland. An alluvial district resting on old rocks, which rise into a north and south chain of hills, terminates the peninsula, and probably there is ground gaining there. Ceylon has its mountain-range in axial relation with that of the Carnatic, and its separation from the mainland has clearly not been due to erosion alone.

The tapering southwards of South America has not been caused by modern denudation. The shape is the result of changes which

occurred far back in time. For Patagonia, from the Andes to the east coast, is a vast pebble-bed worn out of the Andes to the west, and deposited by current and tide on their eastern flank. Upeheaval has occurred on both sides of the chain during the historic period, and thus the present state of things is favouring extension rather than the diminution of the area.

The isthmus connecting the Americas has not been narrowed down by marine erosion. It is the seat of a great volcanic focus, and, as a rule, volcanoes are found, up to a certain time of their existence, on rising land. The Caribbean sea-floor is still an area of unstable equilibrium; and the whole geology of the isthmus proves it not to have been entire during the Mid-tertiary age.

The great land-masses are in the midst of deep oceans, and arise from the floor very abruptly in some localities and less so in others. The old nautical rule, of the deep-sounding being close to the highest coast-line, holds good in the main; but more soundings in abyssal waters are required, before any relation, as regards depth, and the east and west of continents can be enunciated satisfactorily. Sir George Nares, sounding in the expedition of H.M.S. *Challenger*, has shown that on either side of the meridional-submerged 1900-fathoms ridge of the Atlantic, there is on the whole very deep water. The land from the south coast of Ireland to the Cape of Good Hope rises from an average depth of 2500 fathoms, and the opposite North American and South American coasts from 3000 fathoms. The following local soundings are interesting in illustration. The soundings by H.M.S. *Challenger* indicate a depth of from 1525, 2125, and 2250 fathoms from Gibraltar to Madeira; and from Halifax to between Cape Hatteras and Bermuda of 1340, 1700, and 2425 fathoms: both series being about a degree of longitude from the main land. The soundings parallel with the Sierra Leone coast gave depths which were of 1750, 2429, and 2500 fathoms; and those from off Cape San Roque to Bahia gave 1650, 1715, and 1275 fathoms. Off Rio, but nearly 5° of long. to s.e., the depth was 2150 fathoms; and at a less distance from the west of the Cape of Good Hope there were 2325 fathoms.

Soundings south-west of Melbourne gave 2600 fathoms; and along the coast from Sydney, southwards, there is a depth of from 2100 to 2200 fathoms.

To the east of the north-east promontory of Australia the depths range from 1400 to 2200 fathoms; and further south, the sectional west to east line of serial soundings shows that the deepest water is nearest the Australian area, that it shallows to the west of New Zealand, and deepens to the east of the northern island. The

Japanese soundings give 2675 and 2250 fathoms within a degree; and from Juan Fernandez to the west coast of South America there is an oceanic depression of 2225 fathoms. On the other side of the continent, from Cape Corrientes, south of the Rio La Plata, the serial soundings from the shore show from 20 to 64 fathoms for some distance, and then 600, 2425, and 2040 fathoms are suddenly reached along different and successive lines of latitude, from north to south.

It is unnecessary to enlarge upon this relational depth, but it is evident that if the whole of the land-masses be considered as upward and the ocean-floors as downward curves on the surface of the globe, the sum of the depressed areas is vastly greater than that of the land. The relation of land to sea-floor is as 51 is to 146, in millions of square miles, and the average mean height of the land is about 900 feet, the average depth of the water being about 15,840 feet, or as 1 to 17.6.* The idea that the continents slope very gradually to the profound depths of their limiting oceans must be abandoned; and it is evident that marine erosion of the coast, assisted by sub-aerial denudation, will only account for the partial shallowness of the sea in some places near land and not for the sudden dip to great depths.

The sudden slope and abrupt rise from such a depth as 12,000 feet to the land, is in connection with the mountain development along the coast line to a certain extent, but it also relates to the direction of the application of the energy which raised the whole land, and depressed, more or less synchronously, the ocean-floor at a greater or less remote distance.

Faulting or subsidence along more or less vertical lines parallel to the long axes of the coast mountains has produced the abrupt slope in some instances: and it appears that some of the greatest depths are close to volcanic areas, and indicate subsidence from natural undermining.

Certain parts of continental areas have not the stability of others, and slight slow elevation and corresponding subsidences of considerable tracts have been recorded. These relative changes of level are shown to have been considerable during a long period of time, for there is hardly a coast line that does not present either a

* John Carrick Moore, F.R.S., 'Nature,' April 18, 1872, shows that the mean height of the land is in English feet:—

Europe	671
North America	748
South America	1151
Asia	1132

The average is 925½ feet; but as Australia and Africa are omitted, the calculation is of no great value. Probably the mean will be found to be much less.

raised beach or a sunken forest, and which contain the remains of creatures or plants whose species exist in the sea and on the land close by.

But this slight oscillation is magnified around the Pacific Ocean. Its floor is undergoing irregular curvature, the general tendency being downwards, and most of the surrounding land, and notably that of the west of South America and of the whole of the great Asiatic islands, is slowly upheaving. The instability of the continental edges is increased by the vast area of subsidence close to them, and the vertical plane of weak resistance on the rising side, is the very home of the volcano.

Slight as has been the movement of the land and sea floor in apparently a radial direction during the last centuries, it nevertheless is the continuation of that of past ages. Far back in time this really progressive curvature of the superficies, then definite indeed, was the main factor in the formation of the great land-masses.

"As stable and as solid as the land," is an expression justified more or less by the experience of mankind. But as the stability evidently differs in some parts of the continents, and their absolute rest is impossible, so doubts may arise regarding the solidity of the main-land masses.

The idea of solidity is relative, and common sense would almost entitle the scientific geographer and geologist to infer that the ground beneath the stupendous weight of a mountain chain must be compressed into a smaller space and have a greater density than that beneath the plains, deep as the strata may be. The inference is deceptive, and the pendulum, under the study of the late Archdeacon Pratt, indicated that the attracting mass was more energetic beneath the plain than beneath the Himalayas. The same admirable observer* noticed that at seven coast stations out of thirteen, six being in the Anglo-Gallic and one in the Russian arc, it was found that a deflection of the plumb-line exists towards the sea. The bed of the ocean covers denser matter than the strata of the land.

This sub-oceanic density and the comparative lightness of the continental and mountain bases, should not be lost sight of in reflecting on those vicissitudes of the outer parts of the globe which have caused continents and deep oceanic floors to change places, and the last to form the first. The result of the denser state of the globe beneath the ocean beds is to retain the water of the ocean

* 'Figure of the Earth,' 4th edit.

within its limits. Were there no excess of solid matter or no increased density below the floor of the abyssal sea, and were the deeply-seated condition of the whole superficies of the globe the same, tide, winds, and currents would soon aid the movable fluid to invade the land. Herschel considered that the prevalence of land and water in two opposite hemispheres proves the force by which the continents are sustained to be one of tumefaction, inasmuch as it indicates a situation of the centre of gravity of the total mass of the earth somewhat eccentric, relatively to that of the general figure of the external surface, the eccentricity lying in the direction of our antipodes. It is therefore a proof of the comparative lightness of the terrestrial hemisphere.*

Composition of Continents.—The great land-masses are composed of mineral substances, the origin, contents, position, age and changes of which are the peculiar study of the geologist. These substances are arranged, for the purposes of easy study, into sedimentary strata, rocks of an eruptive origin, and those which apparently underlie all others, the hypogene and eminently crystalline. The sedimentary strata form layers, and are either the result of the wearing down of previously existing strata or eruptive or hypogene rocks, or they may consist of layers of the preservable and mineralised remains of animals and plants. Some sedimentary strata are azoic, and retain no traces of the living things of their time of collection, but others may be regarded as the burial-grounds of their age of accumulation, and consist of inorganic and organic matter. Most of these strata collected in water as washdown of earth or as gradual deposit of dead things, and a relatively small number accumulated on dry land, or in lakes, rivers, estuaries and swamps. Strata which collected on the sea-floor at all depths are by far the most common; they are the thickest, and can be distinguished from those of more limited area, and which accumulated in lakes, estuaries and rivers, by the nature of the included fossils, and their greater or less resemblance to recent marine forms.

There is a regular order in the succession from below upwards of the strata, the lowest being the oldest; and they are grouped in great vertical series into so many formations. A stratum may be considered as a leaf of the history of the world and the formation as a chapter, and every chapter should contain evidences of the deposition of the different kinds of sedimentary rocks, and the included fossils differ from those of other chapters in kind. Each chapter is a physical geography *per se*, and illustrates a fresh land-

* Herschel, 'Physical Geography.'

scape or sea view. The formations are numerous, and at the close of each, some gradually increasing movement of the earth's surface culminated, so that the next strata collected on predecessors whose original level had been altered. Between the collection of the top of the lower formation and the deposition of the first grains of the formation next in succession, a physical break occurred. This occupied time, and during its lapse the lower strata were often worn down from being exposed as dry land.

The occurrence of old land-surfaces can be traced, then, in the successive series of deposits which form the continent, and on top of them are often found sediments of vast thickness which collected when that old land had sunk down to form the bed of the ocean. Late researches have proved that the deep sea collects deposits upon and does not denude its floor, and that all thick sediments must have accumulated as the surface on which they rested subsided. On the other hand, strata or rocks on emerging from the sea by upheaval, or whilst stationary as land, suffer denudation, and are carried grain by grain on to the ocean-floor.

Even the land sank here and there, whilst the coast lines remained stationary in the former histories, and layer after layer of land-surface accumulations may be observed for thousands of feet in thickness. As in the coal measures, for instance.

The eruptive rocks penetrated the sedimentary strata, and collected over them in layers, or amongst them in branches and layers. Their accumulation was vast in some chapters of the world's history, and their substances came probably from the underlying hypogene rocks. Accumulating on rising ground, the old volcanoes and the substances which they injected amongst the strata, or cast forth over them, repeatedly fell through the underlying strata by their weight.

Amongst the strata are the relics of the work of minute organisms, and the remains of huge coral-reefs testify to the instability of the surface to which they were attached.

The lowest and oldest sedimentary strata have not yet come to light, for the lowest known contain pebbles of rock which once belonged to an older sediment. Situated probably 20 or more miles beneath the modern deposits, the lower as well as the intermediate strata have been so often upheaved, depressed, folded and bent and worn at the uptilted edges, that they come into view here and there, and particularise the geography of districts.

It was supposed in the early days of geology that the strata of the same formation would be found world-wide, and that North-Western Europe would be the type of the rest of the world : or,

in other words, that all the strata of the formations of Great Britain would be present in the distant land-masses. Geological surveying soon disproved this supposition; and it was shown, moreover, that some strata which form considerable thicknesses and produce remarkable geographical features on the surface, were found in distant countries, but they are absent in the United Kingdom. Thus, some strata common in North-Western Europe are not recognised elsewhere. On the other hand, whilst there was a land-surface interspersed with lakes in England in the time of the Trias, a marine deposit was accumulating in Austria and Northern Italy, not a trace of it being found in the United Kingdom. Whilst the strata of the Carboniferous period were collecting in Europe, and during their subsequent alterations in level and the accumulation of two or three great masses of strata on them—a series of consecutive crust movements on the grandest scale—comparative quietude characterised the regions of Australia and Hindostan. Whilst the area of Hindostan was land, that of the Himalayas appears to have been sea and land repeatedly; and during some of the comparatively stationary ages of the Australian continent, New Zealand suffered several mutations. In fact, wherever great thick masses of strata, forming some land-masses, can be examined and compared with those of other parts of the globe, the truth of the story of a succession of former geographies on the same area becomes evident, and also that the aspects of nature were dissimilar synchronously in remote quarters of the globe. When a considerable horizontal extent of very thick strata characterises the geology of a particular age in one land-mass, and it is totally absent in another, one of two things must have occurred; either the strata must have been denuded from the surface where they are wanting, or they never collected there at all. Careful surveying usually settles which occurrence happened. The existence of dry land on which strata did not collect is proved to have lasted whilst a great depth of ocean was filling up with sediment. On the other hand, denudation and washdown can be shown to have cleared thousands of feet of strata from off the old land-surface, on which they collected ages before. In the last instance, a former geography, without its living charms, is again exposed to view.

In some well-known countries, the geology of which has been carefully studied, very great thicknesses and lateral extensions of strata are found, which were evidently the result of the denudation of some other land and of the removal of the sediment from some distance by marine currents. But this old land cannot be mapped.

Its former position can be determined, however, by attention to the common phenomena of sedimentary depositions. It can often be proved to have sunk subsequently to its denudation, and to have formed the neighbouring sea-floor.

On the other hand, strata of marine origin may be traced over two or more of the great land-masses, and in a general sense they may be said to have accumulated about the same time. Then, the sea covered much of the surface of the earth where there had been previously land-surfaces, and its deposits overlapped them.

Where was the land? Probably the same relative distribution of land and sea has always prevailed, and the land-masses, as a whole, have occupied about a quarter of the surface of the globe. Consequently there must have been land forming up somewhere, as the vast old land-surfaces subsided and became covered up with marine sediment. During the formation of a continent, an ocean-floor, with its thousands of feet of sediment resting on dense, deeply-seated earth-structures, was upheaved to contribute to a portion or the whole of the land-mass, and it then received a less dense sub-base.

Thousands of square feet of marine strata enter into the composition of every consecutive formation of which a continent may be built up, and collecting during the slow subsidence of the area, they relate to lapse of time.* They seem to have occupied eternities in their accumulation. And as the lower formations were subjected to forces, which caused their subsidence or their upheaval and total change of level, the flat becoming often vertical, other lapses of time must be inferred, and they may have been equal to or greater than that just mentioned.

The history of the development of a continent must be considered together with that of the neighbouring ocean-floor, and the growth of all the land-masses with the former condition of the vast depths below the sea-bottoms. The deep sea-floor covers the sunken continent, to which the wear and tear of the land is adding, grain by grain, until the energies within the globe, ever in diminishing operation, cause the uprise of the one and the subsidence of the other.

From the days when the first sediments collected in the earliest waters, to the present time, the mutations of the surface-level of the globe may be compared to a series of wide undulations, slowly progressing and returning, and being more frequent in some regions than in others. Two sets of factors were implicated in the changes :

* There were deep-sea deposits accumulating during every geological age. An assertion to the contrary by Sir Wyville Thomson, is the product of misapprehension of well-observed geological data.

the wear and denudation of the land and the accumulation of sediment and of organisms, and the action of subterranean energies. Climate, changing so often over the same area in the course of the world's history, influenced the first series, and the second relate to the diminishing physical powers within the globe, the outcome of its primitive condition.

It cannot then be a matter for wonder, that whilst there is an endless diversity of detail in the construction of the great land-masses, there has been a steady progression from the simplicity of the oldest to the complexity of the present aspect of their surfaces.

The great land-masses may then be regarded as a volume in the history of the changes of the earth, whose early chapters, although they relate a simpler story, are not so comprehensible as the last, which, nevertheless, refer to complicated events. They require a key or supplement, or a second volume which deals with the inferential history of the neighbouring and distant sea-floors.

Foundations of the Land.—On what are the great land-masses founded? If the oldest consists of sediments, whence were they derived and on what subsiding area did they collect? The answers to these questions are not very satisfactory. Formerly the basis of all sediments was said to be granite or some crystalline rock, and the reason was, not because the oldest stratum had been found resting on granite, but because some very old strata had been found thus placed, and because, when there were no other substances to be seen, granite occupied the surface of the country. But research has proved that granite has often been an eruptive rock, and that it has covered up and got in between strata, and need not have come from a mineral like unto it. Inferentially, a crystalline mass composed of minerals out of which the sedimentary rocks could be worn, the volcanic eruptive substances formed, and granite and such minerals developed, underlies all the sedimentary strata. It may be of granite or syenite, or of acidic and basic rocks containing silica and earthy bases with some metals, or it may consist of a mineral out of which all these can be derived by hydrothermal action.

The position of former Land-Masses.—The oldest formation, as has already been noticed, has not had its base reached. The Lower Laurentian of Western Canada has pebbles of a former land enclosed in it.* The next formation in succession, the Upper Laurentian, overlies the older, which had been worn down and formed into land before its landscape was invaded by the sea

* Logan, 'Geological Survey of Canada.'

during the slow subsidence of the later period. The North American continent was therefore a great land-mass in the earliest days of the sufficiently cooled globe.

The origin of the European continent may have been as early, but it assuredly was in existence at the close of the Upper Laurentian period. The Upper Laurentian sedimentary rocks of Europe collected on a sea-floor, which was probably made up of depths of older Laurentian, and a movement of upheaval brought the mass to the surface in the European area. The first Europe may be traced by the relation which the surface of the upper Laurentian strata bear to the marine and volcanic Cambro-Silurian deposits covering them. It appears from the researches of Mr. Hicks * that large continental areas existed before the Cambro-Silurian rocks were formed. That of Europe seems to have occupied a larger area than at present, and to have extended in a continuous line from north of Norway and Lapland to the Algerian coast and far away to the east. In an east and west direction it appears to have extended from the 100-fathom line beyond the British Isles to Asia. The higher land was in the north-east, and the slope of the area was towards the south and south-west, a difference of level of 15,000 feet occurring between the higher lands to the east and the low lands on the west. The surface of this continent seems to have had more or less of an undulating character, with the higher ranges running in the direction of east-south-east and west-south-west, and the now exposed portions of this old land being part of those hills has the same line of strike. An Atlantic ocean existed even then, and its waves beat upon the south-west coasts of the land.

The next chapter in the history tells of a very slow subsidence of the whole of this land. Being lowest by the sea, the wreckage of the coast accumulated and overlapped the land as it sank below tide-level. So that in the south-west the new sediments aggregated to a depth of from 25,000 to 30,000 feet, but only 1000 feet of strata covered the last relic of the sunken land in the north and where Sweden now is. To the north-east or Russia the depth of sediments is less than in Sweden, and here and there they are absent, their slight coating having been worn off during time. In Bohemia the thickness of these deposits is about one-half of that to the south and west. The accumulation was of great water-worn stones or conglomerates in the first instance, and the evidence of beach condition is perfect. Then rippled sandstones occurred,

* H. Hicks, F.G.S., 'Quart. Journ. Geol. Soc.', vol. xxxi., 1873, p. 552.

indicating tidal flats, and on them collected a fine sediment denoting increased sinking, and that Europe of old was becoming an ocean-floor. In these fine deposits are the first traces of life in the European area. In the extreme north-east only relics of beach or wave action remain.

The sea breached in from the south-west, and the marine fauna was of course best preserved where the sediments which were deposited with its members were the thickest, and it appears that as the land became a sea-floor, migration of forms took place from south-west where the deep Atlantic was.

Much volcanic action took place on some parts of the country as its covering waters silted up and received partial amounts of upheaval, so that ancient volcanoes, lava, and ashes formed some of the details of the landscape and sea-view.

It appears then to be clear that as the sediments on the sinking continent, came from its own high grounds or were the results of the collection of marine organisms and their fossilisation, and as the fauna extended from south-west to north-east, an open Atlantic, without land in the midst, must be admitted.

The examination of the North American continent tells a similar story, and its geology affords good evidence that there was a mass of land there contemporaneously with that of early Europe, the Atlantic being between.

Probably the so-called granitoid gneiss of the Himalayas and the crystalline series of Hindostan which underlie all the sedimentary rocks of that part of Asia, are relics of the Laurentian land.

A second land-mass existed, both where North America and Europe now are, during the Devonian ages. The area was not all land at once, for the remains of coral-reefs testify to its instability. Large bodies of brackish and fresh water existed, the lakes being gradually filled by sediment from the wear of the volcanic rocks noticed before, and which in the lapse of time had become lake boundaries.

In North America, at the close of the Devonian age, a crush took place from east to west, and the prodigious depth of Devonian, Silurian and Laurentian strata was forced into wide curves.

In Europe simple subsidence was the rule.

The next chapter of the history introduces proofs of a vast alteration in the relative distribution of land and sea in both hemispheres. In North America and on the western European areas, the Devonian land was subsiding, and it gradually formed the ocean-floor on which the mountain limestone collected. The main land-masses were probably then in the southern hemisphere. But

as palæontological research has shown that the Australian carboniferous marine fauna is of later date than the European, it must be admitted that the upheaval of the European sea-floor subsequently took place, and whilst the Antipodes were oceanic areas. This upheaval occurred at the close of the Carboniferous Limestone age, and it seems to have produced high land in mid-Atlantic. The next mutation was evidently one of subsidence of the localities whose sub-rock was carboniferous limestone; that is to say, large portions of North America and Europe and the mid-Atlantic continent began to wear down. The former land to the east and west sank, and was overwhelmed with sediment, the result of the wear and tear of an Atlantis. The subsidence was great on both sides of the North Atlantic, and thousands of feet in depth of sand and grits, the result of the denudation of the granitic and crystalline rocks of the coast of the continent of Atlantis, accumulated far away both to the east and west. The greatest thickness of our Yoredale rocks and mill-stone grits of the Carboniferous age, is towards their source of origin, namely, to the north-west; and the corresponding strata in the United States are thickest in the north-east. These sediments were brought by currents and tides from the coast-line in the midst of the former Atlantic. Probably this Atlantis lasted long enough to participate in the formation of the great northern land-mass which stretched from the west of North America far round the globe, and had a connection with a southern continent through Hindostan to Australia, where, later on, these marine tracts were upheaved. This was the age of coal-growing, and the land-surfaces were vast but not always continuous, for very considerable local alterations of level separated or reunited portions of the whole.

At the close of the Carboniferous age there were crust movements on the grandest scale; for the strata which had accumulated were curved along definite lines, and then worn down considerably. In some parts of the great land-mass, subsidence occurred, and in others upheaval, and there is no evidence then of the existence of the Atlantis, which had disappeared. The changes were of the grandest description, were progressive, and not universally synchronous, and they can only be paralleled by those which took place later and after the deposition of the chalk.

Subsequently to this great physical break which terminated the Palæozoic period, there was land on the American, European, Asiatic, Australian, and African areas, and these great surfaces were irregularly united, there being then some land where there was previously sea. In this age of the Trias, the development of the

continental system somewhat resembled that of the present day, if the minor features of the land-masses be excluded. But in course of time during this vast age Europe, Asia and Africa were in union, and probably, for some time, Europe and North America. Australia was linked on to Asia, and later on to South Africa, and probably by insular tracts.

After the establishment of this system, local alterations of land prevailed as they did during the Carboniferous, and considerable seas and coral tracts were formed in and about the vast area. The Jurassic age thus characterised, ended in a grand subsidence, and the sediments of the cretaceous sea covered up the sinking area and the cretaceous continental system began. Where was it? Evidently the greater part of Europe, North Africa, Arabia, Hindostan, and much of Northern and Eastern Asia, Australia, South America, and large tracts of North America were under water. But cretaceous land-surfaces and the edges of the deep sea may be traced in Queensland, the Eastern Himalayas, Central Europe and in the North-Western States of America. It was a land of huge reptilian life and dicotyledonous trees, and somewhere on its surface were reared the placental mammalia. The great land-masses were in the far north and in the equatorial regions, stretching across the world.

The upheaval of the floors of the cretaceous oceans and seas and a corresponding subsidence of the land initiated the distribution of the Tertiary continents of which the present land-masses are the direct successors. The geological record tells of some great local alterations of level which have occurred during and since the tertiary age, and which have produced the infinite variety of the local faunas and floras. Amongst them may be mentioned the subsidence of the coral-island tract which stretched right across the Atlantic, and whose relics may be traced in the Caribbean Islands; the upheaval of the inter-American isthmus, and the permanent union of the North and South of that vast continent; the subsidence of Lemuria; the oscillations of the northern area during the Glacial epoch; and the subsidence of land, probably insular in its nature, to the east of Australia and to the west of the Americas, of which the atolls of the Pacific are the relics.

This rough sketch of the broad history of the great land-masses indicates constant movement of the crust, culminating at intervals, and producing compensatory upheaval and subsidence. It suggests repeated change of level of certain areas apparently, but erroneously, in more or less a radial direction, and it teaches that smaller movements occurred within the results of the greater. The continent

emerged, and simultaneously or subsequently its mountain systems were formed. During its submergence they were covered with deposits, which in their turn, during subsequent upheavals, formed part of mountain systems more or less along the same lines. Moreover, other ranges were produced in serial order, and usually with different orientations.

Considering how the sea-floor has participated in the land-mass formation of old, it must be admitted that far below, where a spare sediment now collects in the abyss, there are stratified rocks, volcanic matters, and the relics of old land-surfaces. The oceanic islands are the monuments of the continent below.

Superinduced phenomena.—Three important series of phenomena have been superadded to the primary formation of great land-masses. One refers to the physico-chemical changes that progress in strata after they have consolidated, and a second to mountain development. Both happen together, and they relate to a certain extent to similar causes; but the first, or the metamorphosis of strata, has always been going on, whilst mountains have been formed at intervals. The consolidation of the substances of continents, and their ability to resist the wear and tear of climate, weather, and water in movement, depend mainly on the mineralogical and mechanical alterations which occur in them. Original substances are replaced by others more enduring, and the minerals re-arrange themselves; soft strata become amongst the hardest, and the preservable parts of organisms have their chemical and mineralogical condition altered durably. A chalk may become a hard durable limestone; a sandy stratum a dense sandstone; a clay a hard slate, and the soft carbonate of lime of the shell may be turned into enduring flint. Even a cycle of events has nearly occurred over and over again. The crystalline rock-granite has been worn down by the elements. and sand and clay have resulted on simple attrition and slight chemical action. During progressive metamorphism they have become hard, and more and more crystalline, until, after a re-arrangement of their minerals, the rock called gneiss has been produced, and gneiss is not very remote, lithologically, from the original granite.

As subsidence and upheaval, or the sinking and appearance of land are compensatory, so is the motion going on in the strata and rocks during these grandest phenomena of nature, for it increases the intensity of metamorphism and thus aids the land in its struggles against the sea. Finally, on the principle that nothing of energy is lost, the chemical and mechanical operations which produce these important alterations in the endurance of the strata, develop

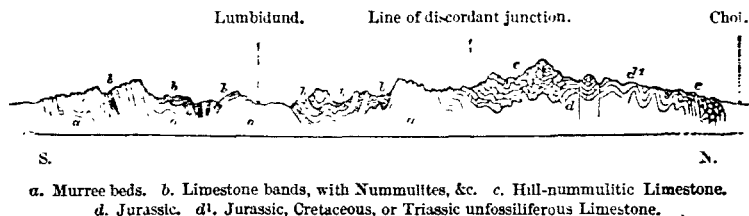
motion to a certain extent, for the substances altered often receive an increase of bulk, or the reverse. The metamorphism of strata and rocks has progressed on every ancient land-surface as well as deeply down: it has produced the endless varieties of soils during the past, and they determine the plant, and on the plant depends the animal.

The grandest features of any great mass of land are its mountains. Worn into all the beauty of peak, pass, valley, glen, precipice, and gentle slope by denuding agencies, the great mountain chains owe their special and characteristic outlines to the durability and position of their component strata. The relative hardness of different strata, due to the nature of their sediment and to greater or less metamorphic action in them, interferes with the equality of the process of external wear and tear. The softer strata are often protected by the harder, and whilst some of their surfaces and edges are friable in the extreme, those of others are so dense and hard that they resist, for a long time, the slow yet sure influence of the atmosphere, the sun, frost, and water and ice in movement. The position of the strata comprising the mountains is invariably in curves. The few or many stratified deposits of which the height may be made up, together with the often included volcanic matters, are seen to be bent, curved sharply, folded, reversed, and broken.

SECTION ACROSS THE CHITA RANGE AT LUMBIDUND, NEAR THE INDUS, SHOWING MOUNTAIN STRUCTURE.

(From Mr. Wynne, "On the Punjab," 'Quart. Journ. Geol. Soc.,' vol. xxx.)

[Length about 6 miles; hills 1500-2000 feet.]



The direction of the curvings is invariably across the geological axis, but a second series may occupy parts along the length. The curves or bends of the strata are in succession, with the convexity downwards and then upwards; and the shorter the chord of the arcs the sharper will be the folding. On the whole the downward curvature predominates, partly because the opposite or anticlinal position favours denudation, and the strata are quickly worn away, and partly from the influence of the energies which

much more of area to the great land-mass, with whose constituent strata those of the mountain ranges are continuous.

The geological surveyor in this country, but more especially when mapping out very extensive lands as in India, has shown, that whilst most mountain ranges consist of the crumpled-up strata that are found to be more or less horizontal, or in easy curves within the continental mass, some include other strata which are not found there.

This fact proves, that although the mountain range is a structure superinduced on its continent, some chains have had a certain amount of independent formation by having been the area of upheaval and subsidence, whilst the main land-mass has been comparatively stationary. They have obtained additional sediments. The Himalayas are a striking example of this, and they were in a state of repeated uprise and subsidence during the comparatively few alterations of the level of the peninsula to the south. Whilst Hindostan was land the Himalayas were often under water, and collecting sediments, and this was especially the case in the Carboniferous and Jurassic periods. During the Cretaceous age the greater part of both areas was sunken down, and there was a general uprise at the close of the period. Since then the mountain area has subsided, and been re-elevated during the comparative stability of the continent to the south. This remarkable peculiarity of some great ranges opens up the question of the direction of the genesis of mountains; just as the statement that mountain chains are structures superinduced on the continental systems suggests the enquiry whether the hills are all of the same age.

The results of orographical study prove that some mountain chains, although they may have suffered the same vicissitudes of level as their supporting continent, were formed during one process; the curvature of their strata having begun and ended without intermission, and during a definite time. Such are termed **Monogenetic**. On the other hand, the study of the Himalayas, for instance, indicates that at least five phases of sediment-collecting and strata-curving, upheaving and wearing, succeeded on the original condition. Mountains of this class are termed **Polygenetic**. Their formation has progressed during many geological ages, but those of the monogenetic type were formed during and at the close of one particular period.

The age of a monogenetic chain, and that of the last effort of curving and upheaving the polygenetic kind, can be decided approximately by the fossils in the last strata which are on the flanks of the ranges, and conform to their slope. It must be younger

than they are. The direction of the chain with regard to the points of the compass may often be a guide to its relative age, consecutively formed mountains usually having a different axial direction or strike.

From mere theoretical considerations, most mountain chains should be formed during continental subsidence; and, doubtless, great curving of the strata and narrowing of the disturbed area has then taken place; but it has not been invariable, and, as an instance, there is proof that the last great uprising and tremendous lateral incrust of the Himalayas took place whilst the whole country was above water.

Being of every geological age, and having been formed on the flanks of continents as they have shifted, some mountain chains have been worn down more or less entirely under the influence of persistent and changeable climate. Hence it is that the great land-masses rarely present great thicknesses and wide extents of nearly or quite horizontal strata. Much of a continent, at the present time, consists of the bases of the old mountains: for the results of denudation have been the wearing of their anticlinals and synclinals down to the level of the plains. This was the case, more or less, in the former continents, and therefore it happened that the broken and curved land was forced into a smaller breadth, and recurved, the original sediments being associated with others, in apparently dire confusion, and one mountain base was formed into that of another.

In concluding this part of the subject, and before passing on to that which will refer to causation, it is necessary to notice the third series of phenomena alluded to, namely, that of volcanic phenomena, in relation to the development of continental masses.

Volcanic substances, which were and are cast forth from volcanos, or which well forth from deeply seated fissures in communication with molten rock, form no inconsiderable part of the land. The old lavas were forced in and over the earliest known sediments; and those of the Silurian, Carboniferous, Cretaceous, and Mid-tertiary ages not only still form prominent parts of the landscape in some of the great land-masses, but are traceable at great depths.

In fact, the ejection from below the sedimentary strata, of hot rock-stuff and mineralised waters, into their midst and over their tops, has proceeded from the beginning. The volcano, to use Mallet's expression, is a cinder-tip over a fissure leading down to molten rock and high pressure steam; and such cracks in the sedimentary and possibly original rocks indicate vertical planes of least resistance. The volcanos could only form along such lines,

and they were, and are, in relation to rising land in proximity to the subsiding ocean-floor. Moreover the lines would necessarily bound the area where the sharp curving of strata in their upheaval become separable from the less disturbed land-area around. The flanks and summits of anticlinoria were particularly the seat of lava-outpour.*

Just where the density of the layers below the ocean-floor diminishes, that is to say, under the neighbouring upheaved land, and where that of the deep rocks of the plain becomes less, far down below the mountain flank, there are, and were in all time, the energies of vulcanicity pent up. Along these areas run the lines of weakest resistance in the superficies of the globe.

It is comprehensible, therefore, that volcanic products should be found nearly everywhere in the construction of the land-masses, and that some which welled forth in each of the ages of the globe should still form important portions of the surface. Such huge surfaces and thicknesses of ancient lavas as the Deccan and Malwa trap, the volcanic districts of Central and Southern America, and the great lava area of the Western territories of the United States all well known and surveyed, are relics of the stages of development of their respective continents.

The great land-masses, thus composed, have not had their principal features completed, geologically, at the same time, and some, or parts of them, were in their present geographical condition long before the others. Africa as a whole, Western Australia, Hindostan, and the Western States of North America have been longer in their present state, or in conditions approaching to it, than the greater part of Europe.

Causation.—Geologists, mathematicians and physicists, whilst considering the causation of the grand phenomena of the great land-masses which have formed the subject of this lecture, are aware that theories have arisen, lasted for a while, and then have suffered neglect from their intrinsic worthlessness. A theory relating to the causes of the phenomena must be explanatory of all of them, must coincide with the past and present physical conditions of the globe, and should stand the test of the comparison between the surface of the earth as it was in consecutive geological ages, and as it is now. It should agree with the deductions of the astronomer, and it should refer to energies which were pristine, and whose results are comparable to work done.

There can be no doubt that heat is and has been the principal

* See the 'Reports of the Geological Survey of the U. S. Territories,' under the direction of Dr. Hayden.

energy in all the long series of terrestrial changes, and that, being internal, it is a relic of the earliest state of the globe, and long before its spheroidal or ellipsoidal shape was determined by the cooling of its viscid, hot and rotating mass.

The principal manner in which the energy of the internal heat can act, is by its passing through substances of many kinds of densities and conductivities, and being radiated into space on coming to the surface. The heat appears to be simply dissipated, but it is so reversibly; for as crystalline and other rocks and strata become cooler, their particles approach each other and contraction occurs, the ratio of cubic contraction being from 1·9 to 6 per cent. in passing from the molten to the solid condition. Motion results, and the heat is transformed into work.

Again, much of the heat has acted, and is still doing so, in producing metamorphism: and volcanic phenomena are closely in relation to this energy. It has produced and is still producing mechanical and chemical changes within the globe, and each one of these represents so much of the energy, there being less to act for the future. This diminution of available energy, in time, is quite consistent with the prevailing philosophy, that the extent and rapidity of the successive changes in the so-called crust, were greater in the earlier geological ages than in those which followed. It moreover explains the comparative quiescence of some of the grandest phenomena at the present day.

The proofs of a considerable heat existing within the globe, are derived from the phenomena of hot springs, volcanos, the minute construction of certain crystalline rocks, and from the results of the measurements of the increasing temperature of the strata and rocks towards the bottom of deep wells and mine-shafts.

Volcanic action and metamorphic phenomena, accompanied by great heat, are traceable in all the past ages of the globe since sediments collected. These facts, and the existence of the equatorial bulge, confirm the opinion that the internal heat was from the beginning; and as the globe is still radiating heat into cold space, or is in other words a cooling body, it must have been hotter formerly. Having thus an agent, it is necessary to consider the relation between the amount of work done by it on the surface, and the internal physical condition of the globe.

The spheroid measures 20,853,429 feet in polar diameter, or nearly 7899 miles; and there are two equatorial diameters, for the equatorial belt is an ellipsoid. One of these diameters is 20,926,350 feet, and the other amounts to 20,919,972 feet: the one being 7925 miles and a few yards, and the other 7923 miles.

Hence the equatorial diameters are 26 and 24 miles in excess of the length of the polar axis. The relation of the extra bulk to the radius of the globe is 1 to 300. A mass of land and sea 12 or 13 miles wide enlarges the globe equatorially on all sides, and slopes down infinitesimally towards the poles. Again, the highest mountain is about 29,000 feet, and the deepest sea is over 4000 fathoms, and strata have been worn off the highest hills, and they exist beneath the deepest sea-floor; so that, even admitting that there is a vertical length of 40 miles between the highest upward curve and the lowest downward bend of the stratified rocks, its relation to the radius of the globe is only 1 to 99.

The equatorial bulge was perfected by the consolidation of the deeply-seated structures implicated in it, and it follows that a great amount of the original heat of the globe had previously passed off into space. And the very small depth of the outer parts of the globe which have been the seat of curvilinear movement, during the secular cooling long subsequent to the formation of the bulge, indicates that much more of the supply of heat had passed away before the first sediments collected on a cooled crust, and that some general rigidity within was even then antagonising the peculiar effects of diminishing temperature on rock-masses.*

At the present time the globe behaves, astronomically, as a body on the whole nearly as rigid as steel. It is as a whole 5·6 times heavier than a corresponding body of water, but all the rocks stratified or presumed hypogene, or underlying or volcanic, have an average specific gravity of less than 3. Hence the deeper parts of the globe are denser than the outer.

As a matter of calculation, the present dense and consolidated condition of the globe, solid in the main as it must be for three-fourths of its radius, and possibly, with local exceptions, to the very centre, is incompatible with the former amounts of curving subsidence and upheaval which produced the great land-masses.† And as the present internal condition is the result of pressure and contraction, it is exactly commensurate with the existing amount of internal heat. It is necessary, then, to admit that during the long ages during which sediments have collected and have been formed into land-masses or ocean-floors, there have been increasing consolidation of the globe and diminishing amounts of original heat.

* The relation of the extent of the displacements of ocean-floors and of continents, or of the curvatures of the surface of the earth, to the whole of the globe is very small. It is therefore very doubtful if a vast amount of molten rock existed during the formation of the land-masses.

† Rev. O. Fisher, Cambridge Phil. Trans., vol. xii. pt. ii.

In other words, the globe was somewhat hotter and less dense; there was more energy and less mechanical resistance.

Biologists very properly insist that the early plants and animals could not have lived on a surface which would derive much heat from below. In the early days of life the sun was hotter, and possibly the atmosphere was denser, and thus solar heat would act most efficiently; but to add to this an earth warmed sensibly by relics of the original heat would be to destroy life. A land-surface with a temperature from below which would double the average of existing land temperature from all sources would prove destructive. These considerations assist the comprehension of the comparatively small results of the former contraction of cooling globe matter, especially when their measurements are contrasted with the diameter of the earth; for although vast to us, the continent and its mountains are but small things on the globe. They enable us to assume that comparatively small amounts of internal heat have existed since the formation of continents and deep-sea floors commenced—small, but diminishing, yet sufficient to deform the spheroidal contour whilst rigidity was increasing, and to produce corrugation of a few miles in depth.

It must be understood that the rate of increase of temperature with depth, as witnessed on examining mining-shafts and wells, although it amounts either to 1° Fahr. in every 50 feet, or to 1° Fahr. in 65 feet of descent, is not in that geometrical proportion which indicates a vast internal temperature of the earth. It is certain that at a depth of some miles the temperature suffices for the liquefaction of lava, with the assistance of water and pressure: and the former and present existence of a plastic condition of substance, underlying the sedimentary strata at great depth is almost a certainty. But below the widely-spread spaces which contain this matter there are not necessarily rocks or substances with greatly increasing heat. Sir William Thomson properly objects to simple rule-of-three being applied to the estimation of the central heat from surface data. The globe appears to have cooled centrally as well as superficially, and its great internal density was probably produced by the contraction during the process. Moreover, it must be remembered that pressure raises the fusing-point of most substances.

The globe has got cooler irregularly. Its surface has had, thanks to the sun, zones of different superficial temperature, and the conduction and radiation of the internal heat would progress faster where the surface was coldest than elsewhere.* It is made up

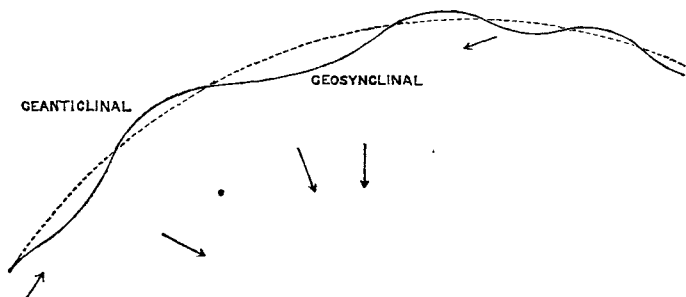
* See Dana, 'Geology.'

of matters of different densities and having different powers of contraction during loss of heat. The globe could not, therefore, contract like a homogeneous sphere losing heat equally from all parts. Under this theory, unequal and irregular contraction of the central parts would occur in diminishing ratios with the dissipation of heat.

The central parts contracting unequally, and not simultaneously, but in some succession, dragged down the masses above them, and the influence of gravitation came also largely into play. It might be thought that simple subsidence in a radial direction would follow, but that is impossible. The downward movement would be resolved into one which acted tangentially, or, in common language, from side to side on the surface of the globe. The amount of horizontal pressure at the surface produced by this side to side thrust is not less than or equal (theoretically) to the weight of a piece of rock of the same section as the stratum, and one-half of the radius of the globe in length.* A still greater side to side pressure than this, would be produced at any moderate depth. This lateral pressure is enough to crumple, curve, fold, and compress, into greater height any rocks or strata; and acting more or less widely, and embracing large surfaces of the globe, it would produce two series of events.

Firstly, it would determine vast curves of the surface down to a certain depth and up to a less height in relation to a mean level.

DIAGRAM OF THE CURVES OF THE SUPERFICIES.



The dotted line is a mean; the three larger arrows point in the direction of the downward movement, which is resolved into tangential thrust in the direction of the smaller arrows.

The chords of the arcs of these curves were so great that the results of the progressive movement, as the undulation crept over the

* Rev. O. Fisher, *Geol. Mag.*, vol. x. p. 248. See his papers in *Cambridge Phil. Trans.*, vol. xii. pt. ii., on "Inequalities of the Surface," &c., and on the "Liquid Substratum."

globe, appear to be radial or vertical. The upward curve produced the great land-mass, and the downward, greater in extent, the ocean-floor. Dana has called these bends of the sedimentary strata and rocks beneath them, geanticlinals and geosynclinals respectively. And the Rev. O. Fisher assumes that the different density of the sub-sea floor, sub-plain, and sub-base of the mountains, relate to the downward curve pressing well into the viscid rock-regions, probably producing consolidation by its pressure, and forcing the liquid and less dense matter under the base of the upward curve.

The history of the great continents proves, that although they have subsided and returned over and over again, yet a neighbouring or distant sea-floor has become continental during the land's subsidence. The movement appears to have been undulatory and progressive, and thus, in theory, have occurred the mutations of the great land-masses.

Secondly, mountains would be produced. The mountain, superinduced on the continent, and situated normally at its confines or where the mobility of the curving would be most effectual on strata, partly has depended upon the grand, and partly upon local and less universally deeply-seated contractions. The mountain mass, although usually curving downwards, still forms part of the great anticlinorium of the continent. The lateral pressure has also been and is in relation with vulcanicity. The volcano situated on the limits of uprising land and subsiding sea-floor, is on an area of unstable equilibrium, and where strata are subject to vertical displacement. Near water and in relation to the deep viscid substratum, the volcanic mountain may be in eruption, and adding to the continental mass. Remote from these conditions, owing to the secular undulatory movement, it has become passive, and has often been bent up and included in the mountain-curves. It may be developed in one place after another as the great land-creep progresses, and its last phase is that of sinking in, by gravitation, and this has taken place on the grandest scale.*

The surfaces of continents, thus marked with the bases of worn-off mountains and volcanoes, are found to be broken down, here and there: and the shores of great land-masses are often limited by prodigious down-throws of strata. These faults, or more or less vertical displacements often of 10,000 feet in downthrow, occurred during or after the uprise of strata in the bending of their

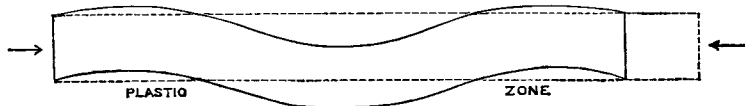
* Probably much of the subsidence of the area now occupied by the Pacific Ocean equatorially, was due to this undermining.

area: and the sinking mass fell into a space corresponding with that which it occupied on or above the surface. This is only explicable on the theory of the existence of deeply-seated viscid layers.

As the mountain-mass was produced by and subjected to tangential thrust, and as it was fashioned from out of a broader expanse of more or less horizontal strata, enormous friction would

DIAGRAM,

Showing that diminution of the breadth of a mass of strata is accompanied by curving, and that the synclinal will intrude on the plastic zone. (See O. Fisher, *op. cit.*)



result. Moving deeply over the viscid deeply-seated substratum, this would be diminished, and the formation of the hills would become possible. And yet some heat would be produced by the shearing movement, and sufficient to assist in the metamorphosis of the strata and in the production of the hot-spring and even of volcanic phenomena.*

Finally, partial upheavals and subsidences of land, probably in a radial direction, have been produced formerly, and have also occurred during the historic period, as the results of the metamorphism of deeply-seated strata and of volcanic action.

Such a theory appears to be reasonable, and to account for the varied history of the past surfaces of the earth, of which the present state of the land is the outcome.

Clearly, all the mutations of the great land-masses have been under law, and the vicissitudes of the surface have resulted in the present geographical distribution of land and sea. The great factors of surface denudation belong to other energies than those which upheaved and modelled the land, but the action of all has been continuous and harmonious. The mysterious energy of life, incarnate on the ever-varying globe, has ever evolved new forms partly under the influence of consecutive changes in its physical conditions. Thus this old earth, so varied in its landscape, so diversely ornamented with an abundant flora, so characterised by its interdependency of animal life, owes all its beauties to a process of development ruled by the mysterious environment of the Creator. The geography of every great land-mass has been

* Mallet, Trans. Royal Soc. 1872, refers to the influence of gravitational energy.

inherited. The older its ancestry, the greater is the beauty and diversity of the surface; and the more frequent the geological revolution, the more charming the valley, the upland pass, and the distant hills shelving to the plain. On the other hand, the greater the long periods of quiescence in the past, the more monotonous is the present land-surface, and the more antiquated are its flora and fauna in appearance. In the first instance, variety in nature and its characteristic geography favour civilisation and all that is æsthetical; and in the last, the image of the former geography is impressed upon man, beast, and flower, and monotony and barbarism reign supreme.

The PRESIDENT said it would be unnecessary for him to point out the comprehensive character and scope of the instructive lecture to which they had listened. Though the lecturer had said that he had only included in the span of his subject the space of 40 miles, from the top of the highest mountains to the lowest downward curve of strata, that journey was almost exhaustive of the knowledge that they could bring to bear upon it. Professor Duncan had maintained the scientific character of the courses of lectures instituted by the Council, and had fully demonstrated the intimate connection between geology and geography. Some of the very startling things that they had been told would give them food for reflection for a long time. When one heard that the plains of Hindustan were solid land while the Himalayas were successively submerged and brought up again, after forming ocean beds and collecting detritus and deposits, one was struck with wonder at the manner in which this earth had been formed into its present condition. They were next told that Australia was once linked on to Hindustan, and then to South Africa; that where the Atlantic Ocean now rolled there was once the great continent, *Atlantis*. Such a succession of changes might well employ all their thoughts for many long years before they could entirely comprehend how, by such processes, even the undulating lateral compression of the crust which Professor Duncan described, such results could have been attained. The present aspect of nature was the outcome of all the past geographies, and it was impossible to feel interest in the surface of the earth as it now existed, without having also a very deep interest in knowing how it had been produced, and what had been in various ages the successive geographies of which there were palpable traces in the geology of the earth. Among the many things in the lecture which had surprised him was, that what was called the New World appeared to be the oldest continent, and in all probability had existed before Europe itself. In conclusion, he asked the Meeting to give a vote of thanks to Professor Duncan for his very instructive lecture.

Professor DUNCAN having thanked the Meeting, and apologised for the too great length at which he was afraid he had addressed them, the proceedings terminated.

Fourth Meeting, 14th January, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Joseph King, Esq.*

ELECTIONS.—*Stephen Clark, Esq.* (Assistant-Master Grammar School, Barnet); *Lewis Vivian Loyd, Esq.* (Grenadier Guards); *Samuel Macdonnell, Esq., Q.C., M.P.*; *Edward Elcock Nicholson, Esq., B.A.*; *Major-General James Puckle*; *Captain Savory*; *Rev. James Frederick Schön*; *Henry Seebohm, Esq.*; *Hubert Foveaux Weiss, Esq.*

DONATIONS TO THE LIBRARY, 10TH DECEMBER, 1877—14TH JANUARY, 1878.—Statistical account of Bengal, by W. W. Hunter, vols. vi.—xx., vols. i.—v. having been presented in 1876; and Reports on Tea and Tobacco Industries in India, 1874 (*H.M. Secretary of State for India*). The armed strength of France, by Major C. J. East, 1877 (*H.M. Secretary of State for War*). Notes on the road through Western Yunnan from Tali to T'eng-yueh, by E. Colborne Baber, 1877; and Survey of the mouth of the Indus in March 1867, by Lieut. A. W. Stiffe (*H.M. Secretary of State for Foreign Affairs*). The Persian Gulf Pilot, No. 26,108, and Supplement, No. 34,794; The Red Sea Pilot, No. 30,331; The Gulf of Aden Pilot, No. 30,472; The West Coast of Hindostan Pilot, No. 4347; The African Pilot, part i. (No. 29,644); The China Sea Directory, vol. iii. (No. 30,251), and iv. (No. 30,495); and Sailing directions for the West Coast of Scotland, part i., 1874, and ii., 1877 (*The Lords Commissioners of the Admiralty*). Records of the Geological Survey of India, x., part 4 (*The Survey, by direction of the Governor-General*). Geological Survey of New Zealand, Reports of Explorations for 1873-74, 1874-76, and 1876-77, with maps to illustrate Reports for 1874-77 (*The Office of the Survey, per Dr. J. Hector*). Annual Report of the Department of Mines, New South Wales, for 1876 (*The Agent-General for the Colony, and the Royal Society of N. S. W.*). Preliminary Report of the Field Work of the U. S. Geological and Geographical Survey of the Territories for 1877; Report of the Survey, vol. xi., Monographs of North American Rodentia, by Elliott Coues and J. A. Allen, 1877, 4to.; and Lists of elevations, 4th edition (*The Office of the Survey, per Professor F. V. Hayden*). Sailing directions for the English Channel, part ii., No. 35 (*U. S. Hydrographic Office, per Commodore Wyman*). *Revue Maritime et Coloniale*, No. 195; *Annales Hydrographiques*, Nos. 577 and 581; *Phares de la Mer du Nord*, sér. A, No. 216, des côtes des îles Britanniques, sér. B, No. 217, des côtes nord et ouest de France, &c., sér. C, No. 218, des côtes orientales de l'Amérique, sér. E, No. 220, and des Mers des

Indes, &c., sér. K, No. 224, par A. Le Gras (*Le Dépôt des Cartes et plans de la Marine Française*). Annales de l'Observatoire Royal de Bruxelles, xxiii.-xxv., Annuaire, 1877, Notices extraites, &c., pour 1875, and Essai sur la vie de L. A. J. Quetelet, par E. Mailly, 1875 (*The Observatory*). Dun Echt Observatory Publications, vol. ii., 1877 (*Lord Lindsay*). Results of Meteorological Observations at the private observatory of John Tebbutt; Sydney, 1877 (*Author*). Repertorium für Meteorologie, V. Heft 2, and Supplement-band i., 1877 (*The Imperial Academy of Sciences, St. Petersburg*). Precious Stones and Gems, by E. W. Streeter, 1877 (*Author*). A treatise on Diamonds and Pearls, by D. Jeffries, 1871 (*Prof. Tennant*). La locomotion aérienne, par — Deydier; Oran, 1877 (*Author*). Report of the Kew Committee for year ending October 31, 1877 (*The Committee*). "Az olesó ebéd," and other Hungarian translations, &c., by E. D. Butler (*The Translator*). The importance of a system of telegraphs, &c., in maritime warfare, by D. Currie, 1877 (*Author*). Zur Kartographie der Republik Costa-Rica, von L. Friederichsen; Hamburg, 1877 (*Author*). Statistisches Jahrbuch der Stadt Pest, 1873; Untersuchungen über die Einkommensteuer der Stadt Pest, 1870; and Die Bauhätigkeit Pest's, 1870-71, and 1872, von J. Körösi (*Author*). Victorian Year-book for 1876-77, by H. H. Hayter; Melbourne, 1877 (*Author*). Ueber die Anforderungen der Geographie, &c., an die geognostische Kartographie, von A. Orth; Berlin, 1877 (*Author*). Lisdoonvarna Spas, by E. D. Mapother, 1876 (*S. M. Drach, Esq.*). Transcaucasia, by G. R. Fitz-Roy Cole, 1877 (*Author*). Newspaper extracts on Capt. Wiggins's voyages to the "Obi" and "Yennesei" (*Capt. Wiggins*). The progress and resources of New South Wales, by C. Robinson; Sydney, 1877 (*Author*). Essai d'Étude positiviste sur le Sud Algérie, par J. Tellier; Bruxelles, 1878 (*Author*). Das Wasser des Baikal-Sees. von C. Schmidt; St. Petersburg, 1877 (*Author*). On the Great Hurricane in August 1873, by H. Toynbee, 1877 (*Author*). The Encyclopædia Britannica, 9th ed. vol. vii. (*Messrs. A. and C. Black*). Lehrbuch der Geographie für die K. K. Militär- Real- und Kadetenschulen, von C. von Sonklar; Wien, 1877 (*Author, per J. Ball, Esq.*). And the current issue of publications of corresponding societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM, DECEMBER 10TH, 1877, TO JANUARY 14TH, 1878.—Map of the Lighthouses on the German Coast (*Dr. Henry Lange*). United States Charts, 4 sheets (*Commodore Wyman*). Admiralty Charts, 13 sheets (*The Hydrographer*). Map of the Colony of New Zealand, 4 sheets (*Sir Julius Vogel*). 2 Maps of the country

round Widin and Sophia (*Col. Home, C.B.*). Map of the Umbara country (*Capt. Wharton, R.N.*). Map showing the primary triangulation of the United States, Geological and Geographical survey of the Territories, 1877 (*Professor Hayden*). Carte Générale du Darien (*Anon.*). Atlas containing a collection of Maps, dating from 1540 to 1590, with letterpress (these Maps are probably reproductions published at Antwerp about 1600 (*F. O. Karuth*)).

The PRESIDENT, in introducing Mr. Seebohm, the author of the first Paper to be read, said that he was a gentleman who had undertaken a journey to north-western Siberia, and down the great River Yenisei, chiefly with a view to studying the ornithology of those regions; but he had availed himself to good purpose of his opportunities of observing many of the physical features of the country, concerning which our knowledge was still so imperfect, and also the manners and customs of the aboriginal inhabitants. Amongst other facts, he had obtained evidence from an early date of a considerable degree of civilisation, in regions which are generally considered as entirely barbarous.

In the latter part of the evening a Paper would be read on the "Transvaal" by Mr. Fynney, Secretary to Sir Theophilus Shepstone, who had lately come to England, and was about to return to South Africa. As he would inform the Meeting, the Transvaal, in addition to its mineral riches in gold and diamonds, presented great attractions to colonists; seeing that farms of thousands of acres may be obtained there in fee-simple for the same sum as would be necessary in England to obtain an acre.

The following were the subjects of the evening:—

1. *On his Recent Journey to the Rivers Ob and Yenisei.*

By HENRY SEEBOHM, Esq.

MR. SEEBOHM spoke as follows:—

Three hundred years ago, when Ivan the Terrible reigned over Russia, and when the Slav and the Tartar races were struggling in mortal combat, a peaceful expedition, commanded by Sir Hugh Willoughby, left the shores of Britain, on a wild-goose chase after the semi-fabulous land of Cathay. It ended disastrously. Poor Sir Hugh Willoughby discovered Nova Zembla, but was afraid to winter there, and landed upon the Kola Peninsula, where he and all his crew were starved to death. Another ship belonging to the same expedition, commanded by Richard Chancellor, or Chalonier, as some call him, was more fortunate. He was driven by contrary winds into the White Sea, and discovered Archangel, where at that time the inhabitants were carrying on a trade with this land of Cathay (China). They made themselves flat-bottomed boats of wood, sewn together with willow-twigs, and in these frail barks they coasted the eastern shores of the White Sea, dragged their boats across the Kanin Peninsula, and sailed along the

south shores of the Arctic Ocean through the Kara Gates into the Kara Sea; thence, by following up a river and finding a place where there was a narrow watershed into a second river, they succeeded in crossing the Yalmal peninsula into the Gulf of Ob, and entering the Gulf of Taz, they proceeded to the town of Mangasea. There they met merchants from China and Mongolia, who brought their wares down the Ob and Yenisei, and bartered or sold them to the Archangel sailors or merchants. In consequence of the discovery of Archangel, and the opening up of the port to British commerce, and as a result of the struggle for existence which then took place, according to the inevitable law of the survival of the fittest, the Russian maritime enterprise came to grief, and was superseded by English commerce, and thenceforth the inhabitants of Archangel received their tea and their silks *viâ* the Thames instead of *viâ* the Ob and Yenisei; and for 250 years, we may say, the commercial world has been of opinion that the Kara Sea is impassable, that the Kara Gates are closed by impenetrable bars of ice. But recently attempts have been made by Professor Nordenskiöld of Stockholm, and Captain Wiggins of Sunderland, to reopen this ancient route.

In 1874 Captain Wiggins chartered the *Diana*, Arctic steam yacht, sailed round the North Cape, crossed the Kara Sea, explored the entrances of the Ob and Yenisei, and returned home in safety. In 1875 Professor Nordenskiöld made the same voyage in a walrus-sloop, landed at the entrance of the Yenisei, sent his walrus-sloop home, and himself proceeded by the overland route, sailing up the Yenisei in a small boat as far as Yeniseisk, and then coming across country to Europe. In 1876 both these gentlemen attempted to take a cargo to the Yenisei. Professor Nordenskiöld was the first to arrive, and landed his freight at a place called Koreopoffsky, a little to the south of Golcheeka. Fortunately he was not able to proceed further, but returned to Norway in the same vessel before the close of the season. Captain Wiggins arrived a short time afterwards, heard of Professor Nordenskiöld's having made an unsuccessful attempt to ascend the river, and determined, if possible, as an Englishman, to do what a Norwegian had been unable to do, and was fortunate enough, as far as the fame of exploration goes, to reach the River Kurayeeka, on the Arctic Circle. As you will see from the further narrative, it proved a very unfortunate circumstance. He left his crew to winter in the ice, and he himself came overland to England. In Sunderland I had the pleasure of meeting him, when he told me he was about to proceed to rejoin his ship in three days. I replied that if he would

give me five days, I would go back with him. I had previously made an expedition to the valley of the Petchora, for the purpose of investigating the ornithology of that district, and thinking that such an opportunity of visiting the Yenisei, in company with a gentleman who knew the routes, might never occur again, I made up my mind to join him as his companion. Consequently upon the 1st of March last year we left London, and travelled by rail, except the short distance across the Channel, as far as Nijni Novgorod, a distance of 2500 miles. We stopped a few days in St. Petersburg, to present the letters of introduction which Count Schouvaloff was kind enough to send me at my hotel in London almost at a moment's notice, and for which I cannot be too grateful to him, as they proved of the greatest advantage to me on my journey. In Nijni Novgorod we bought a sledge, something like a cab upon runners, and we then proceeded to sledge over the snow, changing horses every 15 or 20 miles. We travelled in this way a distance of 3200 English miles, during which we employed about 1000 horses, 16 dogs, and 40 reindeer. The country through which we passed may be divided into four districts: first that of the Ural, lying between Kasan and Tyumen, or rather, I should say, between Perm and Tyumen. Long before we approached Perm we got into a hilly country, and travelled for some hundreds of miles, up one hill and down another, without seeing anything that ought to be dignified by the name of mountain. The district of the Ural reminds me of the Peak in Derbyshire. It is not a single range of mountains, but a succession of hills, and these are covered with forests, principally Scotch fir, larch, spruce-fir, and now and then birches. After we had passed the Urals we came down to Tyumen upon the River Tura. Here we got into an entirely different country. Up to this time we had experienced rather unfavourable weather. When we passed through Moscow we found a thaw setting in, and the streets wet. As we sledged down the Volga from Nijni Novgorod towards Kasan (in March) in many places we had to run through six or eight inches of water; but as we began to ascend the Ural the weather improved; a frost set in, and we had magnificent blue cloudless skies. In Tyumen we stopped a couple of days at the house of a Scotch engineer, who was making engines for the steamers that were being built at this town; and then we proceeded on our journey across the great steppes which lie between Tyumen and Tomsk, through Omsk. This country is almost one uniform dead flat. Hardly anything was to be seen except an illimitable plain of pure white snow, and above us a canopy of brilliantly blue sky, and running across from

one horizon to the other a line of telegraph wires. Now and then we came upon a village, sometimes a Russian village, with a church surmounted by a cross, or a Tartar village, where the crescent stood upon the top of the steeple; and occasionally we passed a stunted birch-wood. In Omsk I had a letter of introduction to the Governor-General of West Siberia, but, unfortunately, he was from home. We, however, paid a visit to his lady. We found that her Excellency spoke excellent English. She had an English governess for her children; and besides that, we heard her speaking in French and German. From Omsk we proceeded to Tomsk, and here we were again among hills, in a grand rolling forest country, with magnificent scenery extending right across between the Ob and the Yenisei, as far as Krasnoyarsk. On arriving at Krasnoyarsk, we were fairly beaten in our race with the south wind. We found that the red hills around the town were, for the most part, bare of snow, and that the streets were running with water, whilst the inhabitants had discarded their sledges and taken to wheels. We hastened on as rapidly as we could. Of course we were unable to sledge, and we had to organise a little caravan of three waggons, one to carry our empty sledge, another to contain our baggage, and a third ourselves. In this way we proceeded due north. For three or four stages we proceeded with our caravan, but as we got farther north the south wind became less warm, the snow lay thicker upon the ground, and eventually we were able to take to our sledge again and proceed as before without the aid of wheels. We arrived at Yeniseisk in hard frost, and stopped there two or three days in order to visit some merchants of that considerable town, of perhaps from 15,000 to 20,000 inhabitants, and also to make arrangements for the further prosecution of our journey.

My chief object was to bring home a large collection of birds; and one of the principal things I required at Yeniseisk was a man who was able to skin my birds for me. I succeeded at length in finding a Jew, who had been exiled there for some forgery or analogous offence, and whose term of exile was just out. He was a young man, perhaps 25 years old. He spoke bad Russian and bad German, and was continually mixing Hebrew with both. However, I managed to make him a tolerably good interpreter, and by giving him a week's lesson in bird-skinning, he was able to skin a bird better than I could do it myself; and during part of the journey, just at the height of migration, when birds were arriving, I may say at the rate of eight or ten species a day, he positively skinned for me, between 8 o'clock in the morning and 1 o'clock the next morning, 47 birds. At Yeniseisk we were obliged to throw aside our

sledge and to take two lighter ones, one for ourselves and part of our luggage, and the other for my servant and the remainder of our goods. Our journey from Yeniseisk was on an entirely different scale. Instead of winding in valleys or ascending hills and driving through forests, we got upon the enormous River Yenisei. Now, the Yenisei is said by Russian geographers—and as far as I know it may be correct—to be the third largest river in the world. They represent the Amazons, in South America, as being the largest river, the Mississippi, in North America, as the next, and then the Yenisei in Siberia. If we take the Angara as the main stream above Yeniseisk, being a much larger river than that which is called the Yenisei, we shall find that this river has already traversed about 2000 miles, and has there a width of, as near as I can estimate, about $1\frac{1}{2}$ English mile.

The PRESIDENT: How deep?

Mr. SEEBOHM: I can hardly say how deep; but I will be able to tell you shortly to what depth it does reach in certain places. From Yeniseisk down to Turokansk, following the winding of the river, is about 800 miles; in which distance beginning with $1\frac{1}{2}$ mile, it gradually widens, until, at the Kurayeeka, it attains a width of a little over 3 miles. Another 800 miles, following the windings of the river, will bring us down to the beginning of what I may call the delta of the Yenisei, where the enormous mass of islands begins. Throughout this distance it will probably average 4 miles in width. It has still 400 miles to run, during which it has an average width of at least 20 miles; so that you have a river 4000 miles long, beginning at 20 miles wide, and gradually narrowing until, even at half its distance, it is still over a mile wide. Upon this enormous river, of course, in the first place, frozen over with ice, and then covered with snow, we proceeded along our sledge-journey, the banks being almost entirely covered with fine forests. In order to give you an idea of the size of these forests, perhaps I cannot do better than tell you of the extreme cheapness of wood in Yeniseisk. You can buy a ship's mast, 60 feet long, 3 feet diameter at the base, and 18 inches at the apex, not made of soft wood but of hard larch, for a sovereign; and if you want a hundred of such ship's masts, you can have them delivered in a week. The whole district, from Yeniseisk to the River Kurayeeka, is one enormous forest, principally larch, but largely mixed with Scotch fir, spruce fir, birch, and a tree which they call cedar—a very fine, handsome tree, clothed with wide-spreading branches down to the roots, and bearing a nut which is consumed as a luxury, as we might eat filberts; and such is the extravagance and waste of timber

in this part of the country that, instead of climbing the tree, which is, say, 3 feet in diameter, in order to gather the nuts, they simply cut it down, pick them off, and leave the trunk. The banks of the river are something like 100 feet in height, and every time we changed horses we had to ride up the steep bank, and, as we came down again, generally some eight or ten villagers were obliged to hang on to our sledge in order that we might preserve the perpendicular and arrive safely at the bottom. I can assure you that sometimes when we looked down the precipice which we had to descend, it almost made our hearts jump into our mouths; but so careful were these peasants, that we never once had an accident on that account. We were upset scores of times on the river, and, in fact, on one occasion I got so tired of being turned out that I lashed myself to the side of the sledge. We arrived at Kurayeeka on the 23rd of April, having had a tolerably fair journey, except in one narrow pass about a third of the way from Yeniseisk. Just at this place the river is much contracted, and there are lofty cliffs of limestone rocks upon either side; the stream is in consequence so swift, that the water in the centre of the river never freezes, even in the hardest winter. We arrived at the entrance to this pass late one evening in a pouring deluge of rain. We had been travelling day and night from Yeniseisk, having had during the whole time a sort of race with the south wind, and here we were fairly beaten. We were told that there was no possibility of going through the pass until the frost set in. We went to bed thinking it might be a week or a fortnight until such an event occurred, and we were not sorry to have a night's rest. It was raining hard, with a warm south wind blowing. However, when we awoke next morning we found the thermometer somewhere between freezing-point and zero, probably nearer zero, with a high wind, and all the snow drifting in clouds of white powder. We were very glad indeed to have our sledge harnessed as early as possible, and to proceed through this pass. This was the last time that we had any appearance of rain upon the journey. Shortly afterwards the south wind left us, and we had either east or north wind, and we arrived at the Kurayeeka, to all appearance, in mid-winter. The Yenisei at this point is $3\frac{1}{2}$ miles broad, and the Kurayeeka about a mile wide. This was on the 23rd of April, and we found the ship frozen into the ice perhaps half a mile up the Kurayeeka. The crew were extremely well, and had passed through the ordeal of the winter very successfully. Captain Wiggins had provided them with ample allowances of lime-juice, which they had diligently

drunk, and also with French dried vegetables; he had also instructed the mate that every day some amount of exercise should be taken, and that through the winter they were to collect sufficient wood to burn during the voyage home. The result was that the sailors passed through the winter without the slightest trace of scurvy. Now I may tell you that a little lower down the Yenisei, among the Brekofsky Islands in the delta, another ship, belonging to a Russian merchant, spent the same winter. This ship also had a crew on board, but no lime-juice was provided nor dried vegetables, and the men, as Russians will do when they are not forced to work, simply lounged and slept the winter through. The consequence was that every man of them died of scurvy except the mate, who just succeeded in recovering. Whilst we are on the subject of scurvy, I may say that it is a very common complaint amongst Russians. They live in houses, and during the winter they are very lazy; and although they make an abundance of cranberry and other kinds of preserves, they are so improvident that they eat it all up during the autumn and winter and have none left in the spring. Now, the natives who live in this part of the country never have the least trace of scurvy. They are equally devoid of vegetable diet, and are as much exposed to the climate; they also have no lime-juice. Their freedom from scurvy probably arises from their living in tents and having an abundance of fresh air, and moving about constantly on the chase. One other reason may be that they are very fond of eating the uncooked flesh of animals.

My object, of course, when I got to the Kurayeeke, was to investigate the ornithology of that district. I immediately purchased for myself a pair of snow-shoes, of which you see several specimens on the table, and by this means I was able to walk upon snow 6 feet thick, with perfect ease, at the rate of perhaps 4 miles an hour. You have no idea of the utter helplessness of a man in 6 feet of snow without snow-shoes. During the time I was waiting there, hoping for spring to come with the migratory birds, I succeeded, during the first week, in identifying about a dozen different species, many of them winter residents, others early summer visitants. During the next week I added three to my list, and in the week following, two; and thus I continued, just adding two or three to my list each week, until June 1st arrived: then suddenly came summer, and during the first week I added 18 to my list, the second week 37, and the third week about 24; when all the birds had arrived, and then I added two or three a week, which had accidentally escaped my notice previously.

During this time we were visited by a great many of the natives. There was a small Russian village on the opposite bank of the Yenisei, opposite the mouth of the Kurayeeke, and many of the natives came travelling in their reindeer-sledges to buy flour and to barter with their furs. There was also one house close to where the ship was anchored, in which a Russian merchant lived, and sometimes three or four sledges a day would arrive there, and the natives would spend the evening with him, some getting well drunk, when no doubt he would cheat them to his heart's content, and get furs from them almost for an old song.

In this part of the country there are several races of natives. The district from the town of Mezen across the Petchora, then to the Ob and the Yenisei, and as far as the North Cape of Asia, running inland for about 200 miles, is inhabited by the Samoyedes, a sallow-complexioned race; with little, round heads; long, straight, black hair; sallow complexions; skew eyes; flat, wide noses, and heavy jaws: men who live very much the life of Laps,—a nomad tribe, having no houses; living in tents, in the summer time made of birch-bark, in the winter of reindeer-skin; travelling with large or small herds of reindeer, dressed in reindeer-skins, and eating reindeer food. A little south of them, in the valley of the Yenisei, on either side of the Brekofsky Islands, come the Yuraks. They are a very similar tribe, speaking a somewhat similar language. Ascending the Ob and the Yenisei, even a little south of the Arctic Circle, you will find a third race called the Ostiaks. These are also very like the Samoyedes, although their dress is considerably different. They must not be confused with the Ouliansks of the Ob, which are a Finnish, and not a Samoyede race. Their language, so far as I could make it out—I paid attention principally to the numerals—was almost exactly the same as that of the Samoyedes. I may here state a very curious circumstance. At Turokansk I was visited by the priest of a race of Ostiaks living in the valley of the River Taz, with whom I had a very interesting conversation. Among other things he gave me their numerals, and a most remarkable feature is, that they count as far as 7, but they have forgotten 8 and 9, and call them 10 less 2, and 10 less 1. Now I find, by referring to an old book printed in 1728, written by Von Strahlenberg, a German, who was exiled to Tobolsk in 1722, that he met with Ostiaks, and he gives their numerals with a distinct number for 8, though not for 9; so that they appear to have forgotten another of their numerals during the last 150 years. Besides these, there is in the district between Dudinka and the River Katangar another race of people, called the

Dolgans of whom I have been unable to find any account in our ethnographical books, very similar to the Yakutes who inhabit the country on both banks of the Lena as far as the town Yakutsk. These Dolgans are quite a different people from those I have been describing. They are more copper-coloured, and dress in a much more elegant style. Their language is almost pure Turkish. When compared with modern Turkish, and the language of the Tartars of Tobolsk and of Tyumen, it is, as far as the numerals go, almost exactly the same. They are no doubt a race of Turks who emigrated before the Turkish races became Mohammedans, the Tartars of Tyumen having separated after that occurrence. All these people that I have described are—I do not like to call them pagans—of the same sort of religion as the North American Indians. They believe in a sort of invisible good Spirit, and they have their idols, but I do not think they worship them. They look upon them very much as images, in the same way as Russians look upon the various crosses and images in their churches. East of the Yenisei are the Tungusks, a tribe speaking a third quite distinct language, neither Tartar, nor Finnish, nor Samoyede.

On June 1st we still had all the appearances of mid-winter. There was no sign whatever of the arrival of summer, except a few flocks of wild geese and wild swans, and we were beginning to feel that in all probability we should have an unusually late season, when, as we came out of the cabin of the ship, we were surprised to observe a small range of mountains form upon the angle where the Yenisei and the Kurayeeka join. These were a range of hills of ice, over 60 feet high, piled in the most wonderfully picturesque confusion. A portion of the frozen river, about a mile long and one-third of a mile wide, in consequence of the rapidity of the water underneath, had broken, and part of the ice had got into the narrow channel which was formed by the gradual rising of the river between the main body of ice and the shore. The other part had rushed headlong on the precipice at the confluence of the two rivers, and the result was the blocks of ice piled themselves one on the other until a complete range of mountains was formed—mountains as blue as cobalt and in some places just like heaps of shivered glass. We immediately set off to visit this curious range. Many of the sailors became frightened, and began to get their goods and chattels out of the ship: however, we thought the wisest plan was not to take any steps at present, but simply to institute a watch, and we went to bed, with instructions that if anything extraordinary occurred we were to be awakened. About midnight the watch called us, when we found that the grand break-up of the

ice had commenced—one of the most extraordinary scenes that it was ever my good fortune to witness—one of the most impressive that possibly could occur. The Yenisei was rising so rapidly that it was beginning to flow up all its tributaries. Captain Wiggins had originally hoped to have taken his ship into a little creek opposite where she was anchored, but the snow had then melted so little, and the river had risen so slightly, that the entrance was perfectly high and dry. The consequence of the sudden rise of the Yenisei was that when the ice began to move towards us, which it shortly did, it came on in the form of icebergs, piled five or six thicknesses of ice, one upon the top of another, and in large floes, at the rate of perhaps 4 or 5, or even 6 miles an hour. Of course, such enormous blocks of ice were utterly irresistible, and the only thing to be done was to cut cable and run with the stream. We were driven up the Kurayeeka for perhaps the distance of 2 miles. Sometimes two large floes of ice would squeeze the vessel between them, and she would be lifted some feet out of the water. At other times a floe would try to crawl up the ship's side like a snake, and on many occasions she was crushed so near the shore that she grounded. One large block of ice carried our rudder completely away, and we never saw it again. During the course of that night things became so serious that we got our luggage conveyed over the ice on to the snow, and finally a large block of ice struck the ship with such force that a stream of water, as thick as my arm, came into the hold. We thought the best thing to do was to desert the ship and leave her to her fate, and we all scrambled on to the banks of the river. However, just at that moment a temporary change took place. Some of the ice lower down the Yenisei must have given way, for the river sank 2 or 3 feet, and the ice began to move down the Kurayeeka, and in a short time we had perfectly clear water between us and the place where we were originally moored opposite the little creek, which was now full of water, and, by guiding the ship with ropes, we succeeded in getting her into the creek. There we ran her on shore, and she was afterwards repaired. For the space of a whole fortnight the mass of ice coming down the Yenisei was carried up the Kurayeeka at the rate of 6 or 7 miles an hour for 4 or 5 hours: then marched back again, and so on until finally the Yenisei, 3 miles wide, rose 70 feet perpendicular in height. The end of it all was that immense masses of ice which had gone up the Kurayeeka further than where the banks were so high, spread out over the country, and were lost in the forest.

During this time migratory birds were arriving in countless

thousands. All this great event in nature was taking place to the accompaniment of screams of gulls, and divers, and swans; all sorts of small birds were arriving, and, of course, my time was entirely occupied in shooting these birds, chronicling their time of arrival and making preparations for skinning, &c. As soon as the ice had dispersed, the steamers from Yeniseisk, belonging to the Russian merchants, came down loaded with all sorts of things; in fact, they were travelling shops. They proceeded as far north as Golcheeka, which is a great fishing-station near the mouth of the Yenisei. There they exchanged or sold to the natives various articles—flour, tea, coffee, sugar, guns, gunpowder, and everything they could require—for furs and salt fish. In this region things are extremely cheap. You can buy dried fish almost for nothing; grouse at 7*d.* a brace, excellent beef at about 2½*d.* a lb., and a little further south, at Krasnoyarsk, a ton of wheat at the same price as we give for 1 cwt. So extremely cheap are corn and hay on the great steppes between Tomsk and Tyumen, that we positively paid for the hire of our horses only ½*d.* per horse per English mile. I had bought a small ship, 56 feet long, in Yeniseisk, with instructions that she was to be sent down with the first steamer, and Captain Wiggins was to rig her for me, so that I might proceed further down the river in her, and meet the Captain at Dudinka. In consequence of the disaster to Captain Wiggins' steamer this programme could not be carried out, and I was obliged to wait in the Kurayeeka until he had completed her repairs and could go with me. Unfortunately he was unprovided with a pilot, and was obliged to have recourse to the builder of my ship, who was tolerably well acquainted with that part of the river, and we proceeded early in July to go down as far as Dudinka; but we had not left the Kurayeeka more than 200 miles behind when another accident befell us. The ship ran on shore, and, being unable to get her off again, we were obliged to leave her there a hopeless wreck. She was afterwards sold, and I and Captain Wiggins, with four of the crew, proceeded down as far as Dudinka in the vessel which I had purchased at Yeniseisk.

At Dudinka the forest has become so small that it can hardly be called a forest—mere stunted trees—and shortly afterwards you pass the limit of forest growth, and enter upon what is called the "Tundra"—a magnificent, wide, rolling prairie country, full of swamps and bogs, lakes and rivers, every little valley a complete garden of the most brilliant wild flowers, swarming with birds by thousands and tens of thousands, enjoying during the summer season a perpetual day. But there is one great drawback to visiting this charming country, and that is probably the reason why it is so

frequented by birds—the myriads of mosquitoes. Life without a veil, I believe, would be perfectly unendurable. I was obliged to wear thick leather gloves, and on many occasions, when shooting, if I was too long in taking aim, I had to shake the barrel to get the mosquitoes off, and then take another aim quickly before they alighted again, otherwise I could not see the bird at all. At Golcheeka I made some interesting ornithological discoveries, but perhaps what will interest you still more is the fact that upon the Tundra, perhaps 500 feet above the level of the sea, and some 3 or 4 miles from the shore, I found large beds of sea-shells, showing that this country was formerly at a very much lower level than at present. A little further to the east is the great mammoth country. It is very seldom that remains of mammoths are found on the Yenisei, but I was fortunate enough to pick up a fine mammoth tooth, which I exhibit here, and I saw many tusks which were brought down from the Katangar, a little to the east of the Yenisei, and which, if I had come home by sea, as I originally intended, I should have brought with me.

Upon arriving at Golcheeka we were fortunate enough to sell our little ship to the Russian captain, who had had his ship wrecked and lost his crew by scurvy, and afterwards obtained another crew. After staying a few days, I left in the last steamer to return up the valley of the Yenisei. The journey was rendered exceedingly interesting by our having two gentlemen on board who had lived between twenty and thirty years in this valley, and who were able to give me a great deal of information. One was a Heligolander, and the other from Saxony; one a voluntary emigrant, the other an exile. After a passage of twenty-four days we arrived at Yeniseisk, a distance of 1800 miles, passing through very much the same sort of scenery as before, already described; but, of course, the birds were of a different class, the summer visitants having all arrived. Shortly before reaching Yeniseisk, we passed to the east the entrances to the great gold-mines there. The beds of ancient rivers are dug down to very great depth, and the gravel and stones are washed. These mines will yield from five to seven tons of gold in a season, and give employment to a great number of men; but unfortunately this is one of the sources of demoralisation in Siberia. Siberia is a thinly-populated country, and very much the same thing occurs as occurred in California and Australia, when gold was discovered in those places. From Yeniseisk I proceeded to Krasnoyarsk, a distance of 500 miles, where I was fortunate enough to pick up a collection of copper utensils or instruments which had been collected

by a gentleman there, and which had been found in the ancient graves between Krasnoyarsk and Minnosinsk, a little to the south-east. One of the interesting points in connection with this collection is the extreme similarity between these articles and those that are found in Yorkshire and other parts of England. In Krasnoyarsk I also visited the Telegraph-office, where I found, upon inquiry, that the number of English telegrams passing through Krasnoyarsk averaged from 500 to 1000 a week; the fact being that the line is one of the routes through which telegrams are sent to China and Japan.

Then I drove as far as Tomsk, where I again got on board one of the Russian steamers, a very fine iron vessel built on the Yenisei, provided with excellent cabins, and with a first-class cook on board, I can assure you it was a very pleasant journey indeed, travelling down the Ob, and ascending the Irtysh and Tobol to Tyumen, a distance of about 2200 English miles. At Tyumen I again had to take to wheels, and I drove across country to Perm, over the most frightfully bad roads which it is possible to conceive, through mud 6 or 9 inches thick for miles together. I do not know how we could have got on at all, if we had not been able now and then to get off the roads and drive along the fields; but an immense amount of traffic is carried on along this route, between Nijni Novgorod and Irkutsk. I think I should not be exaggerating if I stated that, between those two towns, three or four hundred thousand horses are always on the road, carrying tea and wool, and various other products. From Perm we sailed down the Kama, into the Volga; then up the Volga, stopping a day in Kasan to see the Museum; then to Nijni Novgorod, where we entered the railway for the journey home.

As the result of my journey, I brought home a large number of costumes and other objects of ethnographic interest, which have never been exhibited in this country before, 1050 skins of birds, 500 bird's-eggs, and 500 pages of journal.

I must express my most sincere thanks for the kindness with which I was everywhere received in Russia, in consequence of the very excellent letters of recommendation which were given to me by Count Schouvaloff. One very short anecdote, to show how extremely potent they were. When travelling from Krasnoyarsk to Tomsk, with a Russian telegraph-officer whom I had met with, we found there were only six horses in one of the places we arrived at, and that those were reserved by telegram for a Russian General, who was coming from Irkutsk to St. Petersburg. We were then travelling with two waggons, and requiring three horses, so we wanted the whole six. We ordered tea, and sat down to breakfast. Before we

had finished, a Cossack, who had ridden on horseback 30 miles behind us, came up with instructions from the Ispravnik of the last large town we had passed, that the General might go to Hong Kong, but the Englishman must have the horses.

I have no doubt whatever that at some future period there will be an immense trade carried on with Siberia, through the Kara Sea; but it must be organised on some systematic plan. It will never do to attempt to ascend the Yenisei in the same steamer as that in which the sea-passage is made. It is very easy to get up the river, when the stream is running 3 or 4 miles an hour against you: if you happen to get on a sand-bank the stream will very soon get you off; but the difficulty is to come down again with a falling river driving you on sand-banks; and, as a matter of fact, there are no steamers drawing more than 32 inches of water employed on the river by the Russians, and I believe it is the greatest depth to which they can prudently go. The only way will be to have a depot, not at Golcheeka, but at a point somewhere in that neighbourhood, where there must always be cargoes of wheat, hemp, flax, furs, or whatever else you wish to ship to England; so that a steamer arriving from England would have nothing to do but load immediately, and return. Two steamers have found their way there this last season. One, the *Fraser*, went to Golcheeka to take in a cargo of wheat. The wheat was not there, and it was obliged to come home without it. The other, the *Louise*, went up as far as Tobolsk, but I have not heard if it has got back again. The little craft which we sold at Golcheeka crossed the Kara Sea in safety; made the entire circuit of Norway and Sweden, and arrived at St. Petersburg, being the first vessel built on the Yenisei which had made the passage.

I am afraid I have already exhausted the time allotted to me; but if I have succeeded in interesting you, no doubt you will forgive me.

2. *The Geographical and Economic Features of the Transvaal, the New British Dependency in South Africa.* By F. B. FYNNEY, ESQ.

I HAVE been requested to bring under the notice of the Royal Geographical Society to-night our new colony—the Transvaal. I regret that such a subject, the commercial, political, and indeed national importance of which, can hardly be over-estimated, should just at this time have so feeble an advocate as myself. I will, however, do the best that circumstances permit me, to say a few

words upon the matter, in the hope that they will find indulgence at your hands, as being the report of one who has so recently been in the land.

The 'Times' of September 5th says, in reference to this land, "To those who know what South Africa really is, it must be strange to think of the neglect and indifference of the great bulk of their countrymen."

I am persuaded that this general neglect and indifference may be referred mainly, if not entirely, to want of knowledge. And I am sure that when the characteristics and capabilities of the whole of our South African possessions become better known, they must not only attract attention from those at home, but also command the energies of the Empire to develop their resources.

Our new colony, the Transvaal, came into our possession on the 12th of April last. On that day the whole of the territory known as the South African Republic was formally taken over by the British Government, by proclamation of Her Majesty's Special Commissioner, Sir Theophilus Shepstone. The necessity for this act is unanswerably set forth in the proclamation itself, and whatever I have to say in explanation of the proceeding will be directly drawn from the words of that important document.

The history of the South African Republic dates back to February 1858. But the Transvaal has a longer history by some six years. On the 12th day of January, 1852, two Commissioners appointed by Her Majesty's Government met at the Sand River, and conferred with a deputation representing the Dutch farmers who had emigrated across the Vaal River from the Cape and Natal colonies.

This conference resulted in Her Majesty's Commissioners guaranteeing "in the fullest manner, on the part of the British Government, to the emigrant farmers north of the Vaal River the right to manage their own affairs, and to govern themselves according to their own laws, without any interference on the part of the English Government."

Six years after this Convention of Sand River, viz. February 1858, the emigrant farmers framed a constitution, and formed themselves into a distinct government, under the style of the South African Republic. The central law of the constitution, or the "fundamental law," as the farmers called it, was that "the people will admit of no equality of persons of colour with white inhabitants, either in Church or State." The outworking of this law was that the native had no legal status, and was recognised only as a kind of animal; and too often was the subject of oppres-

sion and injustice. This naturally engendered a deep animosity towards the Boers, in the minds of the natives, and ever since 1864 the Republican Government has been harassed by the rebellious spirit of the natives.

In the early part of 1876, the Makatees Chief, Sicocoeni, who was dwelling within the Transvaal frontier, with all his tribe, openly rebelled against the authority of the Government. The war which ensued exhausted all the resources of the Republic, and left the native victorious, thus striking a dangerous blow at the prestige of European power, and jeopardising every European community in South Africa. It became absolutely necessary upon this ground for England to interfere.

The emigrant farmers in 1852 were actually subjects of England, who craved and obtained permission to settle in the country beyond the Vaal River, or, as Sir Theophilus Shepstone has put it, they were "children who obtained leave to live next door to their parents, but having managed to set their house on fire, obliged their parent in the next house, for his own sake, to put the fire out, and to take measures to prevent recurrence of the danger."

The territory thus acquired is of no mean size: it is more than twice as large as England and Wales, and as large as Great Britain and Ireland, having an area of 120,000 square miles, and lies between 22° and 28° s. lat., 25° and 32° E. long. The present population is estimated at 290,000 souls, viz. 40,000 whites and 250,000 natives. The natives I consider as under-estimated in the numbers thus generally adopted: 300,000 would be nearer the mark, and I base this opinion upon actual observation of my own, made while traversing the country in 1875.

The latitude would confer an actually tropical climate, but for the fact that the whole country is table-land, elevated from 2000 to 8000 feet above sea-level. The two circumstances of the elevation and the position in latitude so blend together as to form a happy mingling of the tropical and temperate climates. The 'Times,' already quoted, speaking of the Transvaal, says, "It has a climate probably the finest in the world, and one in which the English race need not fear to degenerate." And this opinion I fully endorse.

The Transvaal is divided by Nature into three divisions, viz., the High, Middle, and Low Veldt. The High Veldt may be said to begin at the Vaal River (the southern boundary of the Transvaal), and to embrace all the territory between that river and the first Magalisberg range; extending to the Hart River on the west, the Drakensberg on the east; and, passing up to the 25th line of lati-

tude, taking in New Scotland, Nazareth, and Leydenburg. It extends over 35,000 square miles. Most of this area is grazing country, having an elevation of from 3000 to 8000 feet, being well watered, and having a fine bracing climate, very dry in winter; and though cold, still not unpleasantly so.

This country is best adapted for the raising of stock, but agricultural pursuits may also be followed in combination with stock-farming; as wheat, oats, and other products, do well. Coal, iron, and other minerals, are found here.

The Middle Veldt contains about 25,000 square miles, and consists of the spurs and slopes of the different mountain-ranges. The broken character of this country gives a very picturesque appearance to the scenery. The ravines and gulleys form mountain-streams during the summer, are generally well wooded, and the flat spots at the base of these ranges offer great advantage for cereal cultivation, on account of the facilities for irrigation. Cattle and sheep do well, especially during the winter months, as the grass here retains its sweetness when that on the higher land is dry. Horses, up to the present, have not been found to thrive, but, no doubt, as the country becomes more thickly populated, this drawback will be removed, in consequence of the greater care and attention bestowed upon the animals.

The Middle Veldt includes part of the rich district of Marico, and what has been aptly termed "the Garden of the Transvaal," namely, the Rustenberg district.

The last great natural division, the "Low Veldt," or Bush country, is the largest of all the three, being upwards of 60,000 square miles in extent. Its elevation is but from 2000 to 4000 feet above sea-level, and it lies principally in the northern parts of the Transvaal. Consequently its tropical situation in latitude, and its lower elevation, combine to render its climate much hotter than that of the other two divisions. Still, the elasticity of the atmosphere, together with its dryness, make it pleasant and healthy in the higher parts. Nothing can be found in either Italy or the southern parts of Europe to excel some parts of the Waterberg. Certain portions of this division adjoining the river-beds and swampy localities are unhealthy all the year round, but principally during the spring and autumn months. Large tracts of country in this part are suitable for plantation-work, and are also known to be rich in mineral wealth.

The three broad districts which have been thus described are divided, for purposes of economy and government, into counties, which are thirteen in number, viz.: Potchefstroom, Bloemhoff,

Marico, Rustenburg, Waterburg, Zoutpansburg, Pretoria, Middleburg, Leydenburg, Leydenburg Gold-Fields, Heidelberg, Wakkerstroom, and Utrecht. Each of these counties has characteristics and capabilities of its own, which are deserving of special notice. The county of Potchefstroom lies within the High Veldt. It has an elevation of from 4000 to 6000 feet, and is well settled; large numbers of Englishmen, among others, who have retired from the Diamond Fields and purchased farms there. It is a splendid sheep-country, and the production of wool is rapidly increasing each year. The whole district may be characterised as of limestone formation. It has only one town of any size, viz., Potchefstroom, which is situated on the Momooi (or "beautiful river"). This river issues from large limestone caverns, about 18 miles to the north of the town. These caverns have been named the "Wonder-Source" or "Wonder Fontein" by the Boers, on account of the river.

It may not be uninteresting to state that these caverns are of as yet undetermined length, and are ornamented by numerous and beautiful stalactites. The river is popularly supposed to have a subterranean course for many hundreds of miles: at all events, its sources have not yet been traced. Some colour to this hypothesis is given by the stream rushing with great force and volume through these caverns, and by fish, found near the mouth, having only rudimentary eyes.

Bloemhoff, the next district on the list of counties, needs but little notice. Its general characteristics are those of the neighbouring Diamond-Fields at Kimberley, and diamonds have been found in it, though not in paying quantities. Sheep, however, do well in the district, and the little town of Bloemhoff, which is only a few years old, is increasing its trade each year.

Marico, which will be noticed on the map as lying on the western borders of the Transvaal, is rich in minerals of different kinds. A lead-mine is now being worked with very good results, the ore containing a good percentage of silver. It is partially bounded on the west by the Natiwani River, and on that side touches the country of the Bamangwato, Bangwaketsi, and Baralong tribes. A considerable portion of this country falls within the line of frontier fixed by the Keate Award. The Bakathla tribe inhabit a part of the northern Bush section. The southern portion comes within the High country, and the northern in the Low Veldt or Bush country.

Wheat, mealie (maize), oats, barley and other cereals; tobacco, indigo, coffee, and sugar; the vine and orange do well. Stock may

also be bred in many parts of it. Beautiful slate slabs and good building-stone abound. A thriving trade is done in Zeerust, the chief town, and as it is on one of the main roads to the interior, this will form a capital station for interior produce.

Rustenburg is one of the western midland districts. The Magalisberg mountain-range traverses the southern part of it, giving rise to the western sources of the Limpopo. Rustenburg possesses great differences of climate, and its productive capabilities are exceedingly varied; the southern sides of the Magalisberg being adapted for stock, while on the northern side tropical cultivation can be successfully carried on. Copper is widely distributed in the middle region, and in the northern parts large game still abound. On account of its varied climate and productive capabilities, Rustenburg, as I have already mentioned, has been styled "the Garden of the Transvaal."

Waterberg, lying as it does on the north-western parts of the Transvaal, has an interest of its own, on account of the beautiful scenery to be found within its limits. The fine ranges of the Waterberg and Hanglip Mountains cut through its very centre from east to west. There is, however, another reason which confers upon this district an especially historical interest.

On the central eastern borders will be noticed a spot marked on the maps as Potgieter's Rest, and which indicates the site of what was once a town of that name. This town was situated in Makapan's Poort, a gap in a mountain-range of great beauty; but it had to be abandoned from two causes—the working of the "fundamental law" and fever. In the sides of the mountain, close by, are caves 2000 feet in length, and between 300 and 500 feet wide, intersected within by walls. In these caves almost the whole of a large tribe was starved to death by the Boers, in retaliation for their Chief Makapan having killed a Boer, named Hermanus Potgieter, and his family. The bodies of upwards of 900 starved wretches were found some time after the terrible tragedy outside the cave's mouth, and as many more are supposed to have been contained within the cave. These mountains are of limestone formation.

To the north of Potgieter's Rest, and about 4 miles, is a conical-shaped mountain, known as the Yzerberg, or Iron Mountain, which is one mass of iron ore, quarried for ages past by the natives. It is commonly asserted that Yzerberg affects the compass for a radius of 10 miles. Vast ranges of granite, intersected by quartz seams, abound in this district. The town of this district is Nylstroom, or Nile Stream, so called on account of the pilgrim Boers imagining that they had reached the sources of the Nile.

Zoutpansburg forms with Waterberg the northern boundary of the State, lying to the north-east. The chief town is Marabastadt, near which a rich quartz gold-reef has been worked for the last four years, at a farm called Ersterling. Standing on the highest point of Ersterling, which, according to the late Thomas Baines, is 5600 feet above sea-level, and looking towards the east, the eye catches the noble range of mountains, named after the late President of this Society, Sir Roderick Murchison, which before long will be found to be rich in many kinds of minerals. Many parts of this district, as well as Waterberg, are infested with the tsetse-fly; but there is scarcely need to attach so much importance to this fact as is commonly done, because the fly is merely a temporary and ephemeral scourge, and always disappears with the large game.

Many parts, which six years ago were known as Fly country, are now entirely free, and therefore it may be fairly hoped that the extinction of this pest is only a matter of time. On the extreme north of this county is the Zoutpansberg range of mountains, which have given the name to the district. They have an elevation in some places of at least 8000 feet, and almost every variety of climate is to be found upon and around them. This range, which is a continuation of the Drakensberg, runs directly east and west, and is composed of sandstone and red granite. Near the junction of the "Blauberg" with this range, there is a huge salt-pan, or Zout Pann, which gives the name of the range of mountains.

It is near this salt-pan that Schoemansdal, the former capital of the Zoutpansberg district, was situated. In the year 1875 I drove through the ruins of this town by moonlight. I shall never forget the feelings I experienced. I had just been hearing from Makato the story of its destruction and the reason.

The district of Pretoria, the central one of the Transvaal, has within itself High Veldt, Middle Veldt, and Low Veldt, and, like Rustenburg, therefore, its agricultural resources are varied. This district is remarkable for three ranges of mountains which intersect it, running from east to west. Pretoria, the capital of this district, is also the capital of the Transvaal and the seat of Government. It is beautifully situated in a broad valley, between two of the lines of the Magalisberg range. It is rich in minerals, and well suited for stock breeding and agriculture.

Middleburg, Heidelberg, and Wakkerstroom may for the present be passed over, with the remark that they are in the High Veldt, are well watered, suitable for grazing and agriculture, and contain great wealth in coal, iron and other minerals.

Leydenburg and the Leydenburg Gold-Fields stand next in the range of districts, and will some day acquire for themselves a larger attention than they have yet received. Leydenburg is unrivalled as a wheat-producing country, and may be looked upon with confidence as a very large and important source of future supply.

The Gold-Fields have been opened for about four years; but the feeble Government under which they have hitherto existed has precluded all chance of their development, and for the last eighteen months they have almost been closed, owing to the war with Sico-coeni, now happily over. Still, with all these drawbacks, they have continued to be worked to some extent.

The latest Government Returns, which are for the year ending December 1875, show that the Natal Bank exported in that year over 36,000*l.* worth of gold, and the Cape Commercial Bank's exports for the same period exceeded 70,000*l.* It is estimated also that at least 100,000*l.* worth more reached England through private hands. The Union steam-ship *German*, last voyage, brought home gold-dust valued at 17,000*l.* So that there is fair ground for considering them payable.

Utrecht, the remaining division or county, forms the south-eastern corner of the Transvaal, and, as the crow flies, is only 100 miles from Durban, the seaport of Natal. It is bounded on the east by Zululand, and part of this district is claimed by Cetywayo, the King of the Zulus, who has, according to the latest accounts, built a military kraal. It may be as well to state, however, that Cetywayo has really no right on the land in question, and the claim put forward is simply the outcome of his inordinate ambition, and of the weak and temporising policy of the late Government.

Its capital, Utrecht, stands about 30 miles from Newcastle, the most northern town of Natal. In this district there are many known coal-seams, one close to the town 7 feet thick. The whole district is well suited for all classes of farming. There is a prosperous future before Utrecht as soon as our Government has secured for it the blessings of peace.

The Transvaal, which I have thus briefly described, is a country capable of great things; but it has for the last nineteen years been kept back from development by the mistaken policy and "inherent" weakness of the Government under which it existed. It must never be overlooked that in assuming the charge of this land our Government has received from the late Republic a heritage of financial, political, and social difficulties of no mean character, and that the overcoming of these difficulties must, under any circum-

stances, be a matter of time. Nevertheless, it is my firm belief that these difficulties will all be conquered, and that the Transvaal will, in a very short time, emerge from the gloom of adversity and misrule, into the sunshine of prosperity and order. The annexation of this great and promising country will not only bring blessing to every inhabitant of the land, but will also reflect honour and credit upon the master-minds that have conceived and effected the bold but wise design.

The natives residing within the borders of the Transvaal are chiefly of the different Makatees tribes, a people unlike the Zulus. They are peacefully disposed, docile, and fond of hunting: both men and women cultivate their land, a thing very unusual amongst the natives of Southern Africa. They show a great aptitude in adopting the dress and customs of the white man; and the abundant testimony of the missionaries stationed amongst them speaks for itself as to their desire to accept the Gospel.

It may naturally be asked, What is the feeling of the native tribes with respect to the annexation? I cannot, perhaps, answer this question better than by saying, that on the occasion of the hoisting of the British Flag in Pretoria, native chiefs from far and near either attended themselves or sent their representatives to welcome the raising of that emblem of *justice* and *freedom*.

In concluding this brief sketch of the Transvaal, I especially desire to draw attention to the certain result of the recent annexation of this interesting territory to the dominion of England. Its influence upon the yet barbarous native tribes, the reversal of the selfish and blind policy of the Dutch pioneers of the country, which was based upon the degradation and serfdom of the aboriginal owners of the soil, are very momentous facts, and cannot be too highly estimated by those who desire the spread of enlightenment and civilisation over the earth. But there is yet another consideration which addresses itself still more immediately to the appreciation and approval of the Royal Geographical Society. I allude to the effectual way in which this annexation drives the point of the civilising wedge into the very heart of the barbarism of this hitherto savage continent.

It is notorious that the Portuguese, and some other maritime nations, have failed in the work of colonisation, and of reclamation of savage tribes. Their traditional course of procedure has been to occupy small isolated trading-stations upon the sea-shore, and to limit themselves to such intercourse with the native tribes as can be accomplished from these limited spots, which they hold, as the natives are shrewd enough to say, with the obvious intent of

securing their escape whenever the land becomes too hot for their longer occupation.

The true colonising races, on the other hand, go forward boldly into the country and settle down upon the soil, introducing all their old habits of life and all their old branches of industry. The settlement of the Transvaal in this way confers also the inestimable advantage of entering the great inland region of South Africa by the natural portal. It is the mere extension onward of the base of Cape Colony and Natal, already securely held, and it not only cuts the Kaffir barbarism of the east from the Bechuana barbarism of the west, but advances by a magnificent stride far onward towards the great central lands, which have become regions of such promise and desire since the recent achievements of Livingstone, Cameron, and Stanley. The extreme northern point of the Transvaal is within 300 miles of the Victoria Falls of the Zambesi, and from above these falls the great water-way of this river stretches on towards the north-west in unimpeded flow, until its sources interlace with the head-waters of the Congo, and actually cross the central plateau where the Portuguese traders from the west meet the Arab traders from the east. It requires no large geographical insight to see that this is in reality the route by which commerce and civilisation will find their way into the strongholds of African barbarism.

This really is the interpretation of the events which are in progress in this part of the earth. Our occupation of the Transvaal is an unavoidable step in the progress of things.

The aboriginal races in these fertile and favoured lands do not die away before the white man, but actually increase with more than their ordinary rate of growth under the advantages and safeguards which he brings. It is from this remarkable fact that the great problem of African colonisation springs. What is to be the ultimate destiny of the primeval occupiers of the soil when they come into contact with the advancing wave of civilised occupation? The problem is a very interesting one, and one which affords a noble field for the exercise of the highest powers of the humanity and intelligent statesmanship that aspire to organise and lead. But whatever turn the present aspect of affairs may assume, and whatever the difficulties may be that have to be encountered and overcome, there can be no reasonable doubt as to what the final issue must be. The black races will either have to accept the civilisation and the orderly co-operation with industrious and law-abiding existence, which is offered them; or they will have to move back, before the advancing civilisation, into the remote

recesses of the land, there to await the next stride of progress. As an actual fact, it will be found that the problem will solve itself in both these ways at once. Some of the native tribes will identify themselves with progress, and gratefully accept the ruling of that Fate which comes to them with the assurance of prosperity and life, and with the accession of comfort and wealth; whilst others will move off into the wilderness, and there still cling to their habits of independence and indolence. But when a native race is once subdivided in this way, that unmistakably foreshadows its end. The noble savage will be swallowed up and lost in the rapid growth and the ultimate predominance of his more advantageously-placed kinsman. And black civilisation will finally swallow up the fragments of barbarism which for a time have escaped that fate.

The PRESIDENT remarked that although the hour for adjourning had arrived, the subject which Mr. Fynney had brought before them was one of great and present importance, and therefore he had no doubt the Meeting would be glad to hear a few words from Mr. Anthony Trollope, who had lately returned from South Africa.

MR. ANTHONY TROLLOPE said he had been very much interested in what Mr. Fynney had said. South Africa was not a colony in the same sense as Australia, Canada, or New Zealand, which were inhabited by white people, but was peopled by coloured races; and the point to be considered was how to rule them in the manner which should most tend to their good, rather than that of allowing white people to rule themselves. One reason why he would not trouble the Meeting with observations at any length was that he had just finished a book, in two volumes, on the subject of South Africa, and he hoped they would all buy it. If they did so, they would do him a great service, and if they read it they would, perhaps, benefit themselves. He would, however, call attention to one point. The City of Melbourne, which was founded less than a quarter of a century ago, now contained 275,000 people of English origin; while South Africa, of which the Transvaal was but a small portion, did not contain half that number. It must not for that reason be regarded as a country of no importance. Rather was it a country of very great importance, for there the English had been able to place themselves on the soil without killing the old inhabitants by contact with them. In New Zealand, Australia, and North America, the aborigines had been destroyed. He did not say that Englishmen were to blame for this. It was a very difficult matter to say whether by any care and good government the natives might have been spared. But in South Africa not only had the original inhabitants not been destroyed by contact with Europeans, but that contact had enabled them to live and multiply as they had never multiplied before. It had prevented tribal wars, and saved the natives from the horrors of pestilence and famine. In Zulu land, in the Transvaal, in Krel's country where the disturbance was at present, the multitudes of the tribes had been saved from the cruelty of their Chiefs, and in that way contact with Englishmen had done them unmixed good. But he did not think South Africa would ever become a British colony in the sense in which that word should be understood. It was not a place to which a British labourer could go and earn wages as in Australia, the United States, or Canada. A man might go to South Africa if he had some little capital, and become what is called a

"boss," and have black men under him, but an Englishman could not earn there 30s. or 40s. a week as a labourer.

The PRESIDENT expressed his regret that the evening was so far advanced that Mr. Fynney had no time to reply to what Mr. Trollope had said regarding the capabilities of South Africa as a British colony. He understood that Mr. Fynney held very different views on the subject, and, considering how vast was the territory, he did not think the time was far distant when British labourers would be able to obtain sufficient remuneration to induce them to go there. With reference to Mr. Seebohm's lecture, he wished to say that the Germans and Russians, as well as the English, believed that an important commerce might be opened up from the Kara Sea, along the Ob and Yenisei, not only for supplying the Siberians with the goods, which they would be very glad to receive, but for obtaining from them grain, hemp, and various other products which grew abundantly there. The only question was as to the facility of transport. He had no doubt that Mr. Seebohm was perfectly right in saying that the only mode in which a large trade could be carried on was by the people of Siberia sending their produce to a port on the sea-coast, where vessels coming from Europe might disembark their cargoes, and at once re-load. It was quite evident that the Russians and Germans were fully awake to the fact that there was an opening there for an enormous trade. The Meeting was very much indebted to Mr. Seebohm for the information he had given them, and also for exhibiting the large and interesting collection that he had brought home. The copper relics might be 4000 years old for anything that was known to the contrary. At all events they were of enormous antiquity, for the Copper age in Siberia, in all probability, corresponded with the Stone age in the north of Europe. Of the Transvaal he would simply say that it was a magnificent country, and Englishmen might congratulate themselves that its annexation was one of the acquisitions of civilisation from barbarism in which they might thoroughly rejoice, without any feeling of regret or any pang of remorse. With all due deference to Mr. Trollope, he had not the slightest doubt that, with such advantages as British rule would give it, it would become a large and important British colony.

Fifth Meeting, 28th January, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*James Alison, Esq. ; A. Charles Baldwin, Esq. ; Stephen Booth, Esq. ; Fitzgerald Hamilton Copland-Crawford, Esq. ; Charles Fielding, Esq. ; Sandford Fleming, Esq., C.M.G. ; W. Henry Fletcher, Esq. ; Thomas William Goad, Esq. ; Francis Hallows, Esq. ; Thomas Henry Ince, Esq. ; Thomas Phillips Price, Esq. ; Alfred E. Rosenthal, Esq. ; Rev. George Gould Ross ; John James Sapp, Esq. ; James Shepherd, Esq. ; William Jameson Soulsby, Esq. ; Samuel Timmins, Esq., J.P. ; Samuel Richard Van Campen, Esq. ; Rev. Arthur Watts ; W. B. Whittingham, Esq. ; George Grey Butler, Esq., Assist. Exam. Civil Service Commission.*

DONATIONS TO LIBRARY, 14TH TO 28TH JANUARY, 1878.—Trois des plus anciens Monuments géographiques du moyen age, conservés

à la Bibliothèque nationale, par E. Cortambert (*Author*). The Siege operations in the Campaign against France, 1870-71, by B. von Tiedemann, translated by Major Tyler (*H.M. Secretary of State for War*). 25th Annual Report to the Council of the City of Manchester on the workings of the public free libraries (*The Council*). And the current issue of publications of Corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM JANUARY 14TH TO 28TH, 1878.—Map of Madagascar, by William Johnson, published at Antananarivo, 1877 (*W. Rawson, Esq.*). Map of the Sarawak Territory of the Island of Borneo, MS. tracing (*H.H. the Rajah of Sarawak*). 1 sheet Admiralty Charts (*the Hydrographer*).

The PRESIDENT announced that Mr. H. M. Stanley having arrived in England, a deputation of the Council had waited upon him to congratulate him upon his safe return to Europe, and to invite him to appoint an evening on which he could give the Society a Paper or a narrative of his explorations and great discoveries in Central Africa. Mr. Stanley had received the invitation with great courtesy and satisfaction, and the 7th of February had been fixed upon for the Meeting. In order that as many Fellows and friends as possible might be accommodated, the Council had thought it right to take St. James's Hall for the Meeting. That Hall was just large enough to admit the greatest number which could expect to hear what was said. It had been ascertained that about 2000 persons could be comfortably seated there, and therefore 1000 tickets would be issued to Fellows, each of whom would have the privilege of introducing one friend by the same ticket. The Council would take care that in proportion as the number of applications for visitors diminished, the number of tickets supplied to Fellows should be increased. Under Rule 6, Sect. 3, Chap. V., passed at the last Anniversary Meeting, that was all that the Council could do. They had engaged the largest room in which a speaker could be well heard, and the whole of the space would be given up to the Fellows and their visitors, with the exception of eighty seats on the platform for Members of Council and their friends, and fifty which were expressly reserved by the rules for visitors of distinction. Not only would an advertisement be inserted in the papers, but a notice would be sent by post to every Fellow of the Society whose address, in the United Kingdom, was known; and in order that those who resided at a distance might not be placed at a disadvantage—which was certainly not the intention of the Committee that framed the rules, nor of the Council or the Meeting in sanctioning them—the applications for tickets would not be opened until the morning of the 30th instant, by which date the Fellows who resided in the country could send in their applications. As the Society had 3500 Fellows, and each Fellow had the privilege of introducing a visitor, while the Hall would only seat 2000 persons, it was quite clear that if all the Fellows desired to be present and to introduce a visitor, it would be utterly impossible to accommodate half the number. There were, however, many Fellows who were scattered over the world, as it was proper and fit that geographers should be, and no doubt there were many others who would not desire to bring visitors: the Council therefore ventured to hope that 2000 seats would be sufficient to accommodate all, or nearly all, who wished to attend. All he could say was that the President, the Council and the Secretaries would do everything in their power to provide as much

room as possible. Of course those who first applied for tickets would be first supplied, and when 2000 tickets had been issued the only answer that could be given would be that there was no more room, and therefore no more tickets. Although some dissatisfaction had been expressed on former occasions of this exceptional character, he trusted that the Fellows would feel that the Council and himself were desirous to afford the utmost possible accommodation for the Fellows and their visitors.

The President further announced that Mr. Stanley had also been invited by himself and the Council to give them the pleasure of his company at a dinner at Willis's Rooms on Saturday, February the 9th. There would on that occasion be seats for 300, and of course when that number of tickets were issued, the only answer that could be given to any further applications would be that there were no more places.

The special object of the present Meeting was to listen to an account of two journeys by Mr. Erskine in a part of Africa which was daily becoming of more interest. Mr. Erskine had made no less than four journeys there; and Dr. Mann, who for twelve years was officially employed in Natal, and was thoroughly familiar with the country, who was moreover a great physicist and President of the Meteorological Society, would summarise the contents of the papers which had been received from Mr. Erskine. On one of his journeys Mr. Erskine went on a kind of mission from the Government of Natal to Umzila, the chief of the Gaza country, which stretched from King George's River in Delagoa Bay to the Zambesi. That was a part of the continent which was very little known, though there was a great deal of interest connected both with its inhabitants and the physical character of the country. Without any inordinate desire to acquire new territory, Englishmen could not overlook the probability that in the course of time and in the progress of events, British colonies would stretch from the Transvaal to the Zambesi River. In that case the Gaza country would be included. If time permitted, a paper would afterwards be read on Lord Howe's Island. Though probably many persons had never heard of such a place, it had an actual and real existence. It was situated to the south-east of Australia, and was named after Lord Howe. There were a few white colonists there, who supplied whalers and other chance vessels that call. A visit had been lately paid to it, and the Paper described the present state of the colony and the island.

The following Papers were then read:—

1. *Two Journeys of Mr. ST. VINCENT ERSKINE in Gaza Land, during the years 1873, 1874, and 1875.* Adapted from MR. ERSKINE'S Journals by R. J. MANN, Esq., M.D.

[ABSTRACT.]*

Dr. MANN reminded the Fellows that the record of two preceding journeys by this explorer in the same territory is already in print in the 'Journal' of the Society.† In the first journey Mr. Erskine, having parted company with Karl Mauch at Lydenberg, in July 1868, made his way down the Oliphant's River to its confluence

* By Dr. Mann.

† See 'Journal of the Royal Geographical Society,' vol. xxxix. page 233; and vol. xlv. page 45.

with the Limpopo, and then, with great resolution and enterprise, explored the main stream downwards, to its mouth, and so identified it with the Inhampura entrance from the sea. His second journey consisted in an embassy from the Government of Natal to Umzila, the paramount chief of the Gaza territory, which extends for a considerable distance along the coast region between the Limpopo and Zambesi Rivers, and was accomplished in the years 1871 and 1872.

The third journey, in 1873, was undertaken in the hope of inducing the chief to allow a passage through his dominions to Umsilikatse's Land, and the interior of the continent in that direction, for purposes of trade. The mercantile firm of Dunlop, Mees, and Co., of Rotterdam, having undertaken to give substantial assistance to the adventure, Mr. Erskine started by sea for Delagoa Bay on the 12th of May, 1873; and made his way thence, first to the Portuguese settlement at Inhambane, and afterwards to the Island of Chilwana, which lies off the delta of the Sabi, with a narrow and sheltered sea-channel between it and the mainland. He found upon the island a mixed population of Europeans, Moors, and half-castes, amounting in all to about 4000. There were two French merchants residing in the settlement, who carried on the trade of the mainland through natives. From this place Mr. Erskine reckoned the distance to Umzila's kraal as not more than 135 miles. He entered the delta in a boat, by a creek named Maluli, and went first to Manama's kraal, and from that to the station of Nonxanga, the Zulu governor, on the Sabi. He again here remarked upon the wretched condition of the aboriginal tribes, who are held in subjection by the conquering Zulus. These subject native tribes are classed together as Tongas, which, it will be remembered, is merely a term of reproach conferred upon them by the Zulus, who are themselves distinguished by the more honourable designation of Umgonis. The Umgonis are, however, indolent and cruel savages, and live pretty well by robbing the Tongas, so long as there is anything to seize. Bearers were, after some delay, furnished by Nonxanga, and a trading party was sent out to barter for ivory, but entirely without success, because a Zulu overseer was attached to this party, and the Tongas took especial care to have no ivory wherever he appeared to assist in the negotiations.

Four donkeys having come up from Inhambane, Mr. Erskine sent off 50 loads of merchandise *en route* towards Umzila's, and followed with 30 hunters. He found the stream of the Sabi 18 inches deep, meandering through a broad sand-bed not less than a mile wide. The donkeys carried him with great comfort, and returned

with him, after a journey of 400 miles, to the coast, and he attributed much of the immunity from sickness, which he enjoyed upon this expedition, to the good service rendered by these animals.

Having overtaken his porters, he travelled with them about 12 miles a-day along the Sabi, and finally built a three-roomed store upon the banks of the stream, and deposited the main bulk of his goods there, whilst he pushed on in light marching order with the present destined for Umzila. He passed through the Hlenga and Mandanda tribes. Amongst the Mandandas the women were habitually naked. He was surprised also to find these people eating dogs, which were fattened up for the purpose, and rats; the explanation given him was to the effect that "the Zulus eat goats, but do not eat dogs;" and that therefore the Mandandas had found it convenient "to turn their goats into dogs." They build their huts in the dense bush, away from water, to avoid the unwelcome visits of the Zulus. The route from this lay by a very gentle ascent through dense bush, and over broad plains interspersed with water-pools, until at a distance of 95 miles from the sea the height of 1250 feet was attained. A little further on, the lofty inland mountains were in view, and the party descended to the channel of the Bosi, and afterwards traversed a district termed Umtonto, consisting of forest-covered rocks and hills. Below this the track would have been practicable to waggons. But from this, upward, no waggon could by any possibility have made its way. Mr. Erskine joined his old track of 1871 at Yanda's kraal, where he greeted again with much friendly regard a lemon-tree, which had rendered him good service in sickness on his previous visit.

At this place Umzila's messengers came to him, to invite him to the Royal kraal. He found the chief at one of his gardens celebrating the opening of the hunting season. Umzila asked him to bring his merchandise up. Mr. Erskine declined to do that until the weighty question of further progress was settled. The chief ultimately proved quite obdurate on the matter of passage to Nohengula, Umsilikatse's successor, and to Manica. He told Mr. Erskine he was keeping the gold of Manica for the time when the ivory of his own forests and plains was exhausted, and that he had no intention of letting white men meddle with that.

Mr. Erskine gleaned that Umzila stood in fear of the Dutchmen of the Transvaal, but had no anxiety about the English. He considered the Inyanisi, or Queen, too far away to do him any harm, and that Cetywayo, between him and her, was virtually an efficient protection and screen. This offset of the Zulus did not appear to Mr. Erskine to be very powerful or formidable; they held the

Portuguese, nevertheless, in great contempt, and said that the Portuguese authorities kept near the sea, that they might be always ready to run away. The climate near the kraal, which was called Tshama Tshama, and was situate in $20^{\circ} 22' 30''$ south latitude, was apparently very fine, favourable to the growth of wheat and the vine, and for the feeding of cattle, and for the cultivation of tropical produce in the sheltered valleys. The mountain slopes around were covered with forests, with trees in places 4 feet in diameter. There were about 1000 cattle feeding on the pasture, which seemed to have been mainly spoil taken from the Amadumas. But there were amongst them unquestionably some oxen that had been procured in Zoutpansberg some years before. The influence of Umzila amongst the neighbouring tribes depends principally upon his reputation of having several powerful wizards, or magicians, in his service, who are able to work upon his enemies by incantations and sickness.

Mr. Erskine remained with Umzila about two months, and then obtained permission to return to the Sabi. Upon taking leave he received a present of eight tusks of ivory, and authority to hunt the elephants in the district of Magibbi.

The rainy season had fairly set in, at the beginning of the month of December, when Mr. Erskine commenced his return. The Sabi was almost impassable from flood when he first reached it, and occasioned him some troublesome delay. His store further down was, however, all safe, and he there turned his attention for some time to an attempt to establish trade. He went up the river for this purpose as far as the place of the Zulu chief Syngyingu. The river was at that time alternately rising and falling, and indicated its depth by the character of the foam, which drifted along upon its surface. The current was too strong for any boat to have been able to make way against it. The temperature of the air ranged at this season between 74° and 105° . Mr. Erskine enjoyed a considerable reputation as a rain-maker, because it so constantly happened that heavy rain set in immediately after his arrival at a kraal. An old chief, Soudaba, once brought him three fowls as a fee for making rain. He answered that he could not practise so cheaply, and that he must have at least a goat. Soudaba went away, and a thunderstorm occurred almost immediately, followed with a deluge of rain, that continued for three days. Mr. Erskine did not, however, think that his reputation in any way suffered, because the event was interpreted as having indicated that he had relented after his petitioner's departure.

The general result of the enterprise proved that no trade was to be

done. The fear of the Umgonis was too great to permit the natives to produce their marketable stores. As many of the goods were therefore got rid of as could be bartered at any price, and there then still remained about forty loads of merchandise to get back to the coast.

On the 7th of January, 1874, the stream of the Sabi was a mile and a half wide, and deep enough to have floated a ship of 100 tons' burden. A vast expanse of turbid brown water was rolling down and submerging the islands, and often even the trees. Mr. Erskine descended the rapid stream in a canoe, until approaching the coast, when he turned aside into the Macowa Creek, and then paddled along through inshore creeks and lagoons, at one place having to make a dangerous passage of a gap in the outer defence where the sea-waves rolled in. In this network of channels he found the tide often flowing in both ways at once. The channels were in many places almost choked with mangroves. He finally reached Chilwana on the 22nd of January, after having traversed 100 miles of the mangrove-swamps of the delta in a "dug-out" canoe, and he ascertained that this inshore water-route was the great seat of the traders' operations. At Chilwana he received the first news of his brother Robert's death, which had occurred in the conflict with Langalibalele's people on the mountain frontier of Natal.*

Having made two or three short trips in the delta, and collected the ivory which he had left some little distance up the river, he visited the lagoons towards the mouth of the Sabi; and also examined the mouth of the Gorongosi, which enters the sea, not at Sofala Bay, but at a place marked Boene on the maps. This place is an island in the delta, and is an old Moorish settlement, with a clump of coconut-palms planted by the original possessors. It furnishes a good harbour for small vessels, and has an export of bees-wax. Mr. Erskine remarked that the coast in this district abounds with practicable harbours, from the Inyambesi to the Macocoa.

From Chilwana Mr. Erskine made his way by boat to Cape San Sebastian, then travelled overland to Inhambane, and there embarked in a steamer for Delagoa Bay, examining the Usutu River on the passage.

Mr. Erskine believes that the route from Chilwana to Umsilikatze's country and Maschona Land, past Umzila's kraal, would have proved very serviceable and direct, if he had found that chief

* It will be remembered that the 'Athenæum,' and some other journals, erroneously spoke of this incident as applying to Mr. St. Vincent Erskine himself. He, however, is happily still alive in East Griqualand.

favourably inclined to open it out. The distance was certainly not more than 140 nautical miles from Chilwana to Umzila's kraal, and he estimated the distance of Umsilikatze's old kraal, from that, as being about 200 miles further.

Towards the end of 1874, Mr. Erskine again sailed from Natal, to endeavour to turn to account the permission to hunt the elephant, which he had received from Umzila. He engaged 100 native hunters at Lorenzo Marques, in Delagoa Bay, and having landed from Bazaruta, joined them on the Mauhlin coast, in the month of November. He then continued hunting between the 23rd parallel of south latitude and the Sabi, until the following June, living the rude hunter's life during that time. He was destitute entirely of tea, sugar, and crockery, and subsisted chiefly on elephant-meat and water. The hunting, however, by no means proved a success; the game was comparatively scarce. About 90 tusks were secured; but Mr. Erskine found that, for an expedition of this kind, each hunter requires a provision of 15 lbs. of gunpowder, 70 lbs. of lead, and 450 percussion-caps, which would have amounted for his own party to 150 lbs. of gunpowder, 7000 lbs. of lead, and 45,000 caps.

Mr. Erskine intended upon this occasion to escape the necessity of a personal visit to Umzila, by sending him a present of guns up direct from Bazaruta. He, however, received a peremptory summons to go to the chief. He went up to the Royal kraal, again travelling upon a donkey, and crossed the Sabi by a track 40 miles lower down than the one he had travelled before. He found the chief at a new kraal at Sinika, called "Utshani Udi," or "the place of long grass;" and it proved that what the old despot wanted was a silver ring, which was to be engraved with a lion rampant, and with an inscription recording the name and title of Umzila, the paramount Chief of Gaza.

The visit to Umzila was made in March 1875. The interview was brief, and altogether unsatisfactory, and led to no practical results. After his return from the Sabi, however, Mr. Erskine came into communication with a very interesting and fine tribe, known as the "Marongwes." He characterises these people as being quite the finest specimen of the native races that he had encountered. They are of the same race as the Chobis and Mandandas, and bear a striking resemblance to the Basutos. They carried strong six-foot bows, and were skilful bush-fighters. But the most remarkable peculiarity about them was that they lived in compact communities, clearing and planting large stretches of

ground—sometimes of more than 100 acres in common, and dwelling with their families in huts built round the clearing.

The country was thickly inhabited, and abounded in fowls, corn, beer and honey; and in many places also yielded coco-nuts, bananas, and sugar-canes. Baobab-trees of great beauty commonly spread their shade over the cultivated gardens, festooned with creepers, and furnishing canopies of shade impervious to the rays of the sun.

From the large extent of ground which he traversed in pursuit of game, Mr. Erskine acquired considerable familiarity with the physical characters of the different districts, which are so distributed in belts as to serve as indications of locality to the hunters. Many of these are designated, and will be found accurately described in the Paper, to be hereafter published in the 'Journal.' Incidentally allusion is also made to edible fruits, the most notable of which are the Simwerbi, which varnishes the moustache with its india-rubber juice when it is eaten; the makwaka, the roasted and pounded testa of the seed of a calabash, which is packed into drums, and the shugutsa, which is the same delicacy prepared green. The plant which yields poison for arrows, a species of *Strephanthus*, is described as being in all probability identical with that met with in the Zambesi districts by Dr. Livingstone.

The Mandowa, who inhabit the hills above Sofala, appear to be of Makalaka blood, and to have submitted to 'Cnaba, the Zulu potentate who first seized this land, without fighting. They still have their own chief living on the Umkinde towards the north. The so-called Tongas of the district are in reality Chobi, Basige, Bila-kulu, Mandanda and Mandowa.

In reference to the general question of trade, Mr. Erskine remarks, as a practical deduction from both these journeys, that curiously enough the opportunities for traffic diminish with penetration into the native districts. India-rubber, bees-wax, and ivory are cheaper at the Portuguese stations at Inhambane than they are in the interior, where the articles are produced. The natives take advantage of their opportunity when heavy goods are transported to their doors. They know that the white trader will ultimately dispose of them in such circumstances at any price, rather than have to carry them away again. When, however, they take their india-rubber, wax, and ivory down to the coast settlements, the argument tells in the opposite direction. No trade of any kind is practicable with the Umgonis or Zulu section of the community.

They hold the doctrine that trade means that substantial goods are to be exchanged for empty and never-to-be-fulfilled promises. The most available goods for barter were found to be eight-yard pieces

of blue buftas, thirty-two inches wide, red and white striped salempores, blue-ground prints, and red Umgazi beads about the size of a pea, with a white eye. Muskets, powder, and caps were in quite limited demand. Blankets and fancy goods were unsaleable, and iron picks for the cultivation of the ground were not worth the trouble of transport.

[Mr. Erskine's Paper, as condensed by Dr. Mann, will appear *in extenso* in Vol. xlviii. of the 'Journal'.]

Mr. GALTON said the readers of the Society's 'Journal' were greatly indebted to Dr. Mann for editing Mr. Erskine's Papers, which reached England in the form of a diary much too voluminous for publication. Dr. Mann very carefully edited one of the Papers referring to Mr. Erskine's previous journeys which had already appeared in the 'Journal,' and in the same way he was about to edit the account of the last two journeys. The interest of the country through which Mr. Erskine had travelled was greatly enhanced by the possibility of part of it hereafter becoming colonised by men of English race, and he wished to ask Dr. Mann some questions concerning its climatic conditions. The northern part of the Transvaal was as near the Equator as Calcutta, but although it was sub-tropical, the interior was high above the sea, and therefore enjoyed a more favoured climate than the low lands of Calcutta. How much more favoured it was, was the question he wished to ask Dr. Mann—how far an Englishman could perform laborious work in those latitudes, or whether agricultural work must not be done for him by the blacks? Could the English race thrive and multiply there? Did the children become sickly? He understood that the Dutch had thriven unexpectedly well in Pretoria, and it would be exceedingly interesting to know if our Anglo-Saxon race was likely to flourish there. Perhaps at the same time Dr. Mann would give them some information with regard to the products of the country, more especially as to its capabilities for growing wool. It was well known that sheep lost their wool in hot countries, and he wished to know if the Merino and other new breeds were likely to flourish and bear wool in the northern part of the Transvaal, between the Limpopo and the Zambesi.

Dr. MANN said the climate was a most extraordinary one. For nine successive years he had studied the climate of Natal in the most scientific way. He endeavoured to obtain correlative observations in the Transvaal; but, in consequence of the fact that people there did not care much about science, he could get no actual results that he could rely upon. At the same time, he obtained a good deal of information which he could check by what he knew with regard to his own districts. In the highlands of Natal, with a temperature from 95° to 97° in the open air, which was the highest he had ever known there, a person could ride all day long without exhaustion. The children of white people in that district were healthy and strong. On the coast, however, the children were sallow and languid. The same thing no doubt occurred in the Transvaal, where there was almost every variety of climate. He would not advise any Englishman to live north of latitude 25°, for beyond that line the country was subject to fever; and, until the climate was altered by cultivation, no European could safely venture to live there. The central districts, however, were as healthy as Natal, and the children of English parents were as vigorous and red-blooded and healthy as in England. In the district around the Drakenberg Mountains the climate was so good that horses multiplied and sheep flourished admirably in at least two-thirds of the Transvaal. The great drawback to wool-growing was the fact that while during eight months

of the year food for all kinds of animals was produced in abundance, during the other four months there was no food to be had, the land being dry and barren. The old Dutch Boers turned the flank of this difficulty, for they always took care to have warm lands down on the sea and cold lands up in the mountains, and they moved from one place to the other at different seasons of the year, so that they always kept up a certain amount of stock. They considered that each man required 6000 acres on the coast and 6000 acres inland. What was required was that during the season of superabundant growth the products of the earth should be harvested for use in winter. A friend writing to him from that district a short time ago, said, the two things which were chiefly wanted there were sewing-machines for the women and reaping-machines for the men. Hitherto the land had not been cultivated during the summer in such a way as to provide an abundance of food for the winter. He thought that Mr. Trollope, who spoke at the last Meeting, had made a radical mistake with regard to labour. He said that the Transvaal would be a place where the English could do a great deal of good for the natives, but where they could never establish a colony. It might be true that Englishmen might not be able to go there and live from hand to mouth, because of the cheapness of native labour; but the fact was, when an Englishman landed there with half-a-crown in his pocket, he managed in less than twelve months to employ twenty black labourers. Of course that depended on skill and observation. Some men in Natal would fail where others would make little fortunes; and his friends told him that in the Transvaal everything could be done which could be done in Natal. While the coffee crop was failing in Natal, all along the slopes, looking down to the Zoutpans and Rustenburg, it was being successfully grown. The people must, however, learn to insure themselves against loss in the seasons of drought. Within his own memory the whole of Cape Colony was fed by oxen from the Transvaal; and for something like thirty years all the beef consumed in the Cape Colony was obtained from the Transvaal. At that time no lung sickness was known there. In consequence of the scarcity of food in the winter, the staple of the wool became weak and valueless. In order to obtain good wool, the sheep must be well fed. During the period of abundant growth in the Transvaal the wool was splendid; but when the sheep were starved, the fibre was thin and useless. In Natal, where artificial food was given to the sheep, that difficulty was got over, and no doubt a similar result might be obtained in the Transvaal.

Mr. HAMILTON said he was rather surprised to hear Dr. Mann state that, in consequence of the sheep not being sufficiently well fed, the wool "broke off." In Natal, sheep were subject to a disease appearing in the form of a mattery incrustation; the animals became very fat, but the wool was perfectly useless.

The PRESIDENT said Dr. Mann's answers to Mr. Galton's questions had added very much to the interest of the Paper. It appeared that the Zulus had nothing to learn from Englishmen in the way of tricks of trade, for they were perfectly aware that if a person carried his goods a great distance inland, it would not pay him to take them back again. This confirmed what a writer in the 'Edinburgh Review' had lately said with reference to Mr. Stanley's magnificent discoveries on the Congo,—that although there were great water-courses leading into the interior, if there were considerable interruptions, making communication with the coast difficult, that would interfere very much with the development of a large commerce between Europe and the centre of Africa. Although Nature had done very much for all those regions, unless man applied his intellect to their development, so as to provide for the loss in one season by the superabundance in another, the districts could not be cultivated with any great advantage. He thought the evidence proved that the country described by Mr. Erskine was one of splendid promise for the farmer,

and for an agricultural population, though no doubt it would be necessary to combine the cultivation of roots with pasturage. Farmers who went out from England would not, however, take long to learn that.

Dr. MAXX said he quite agreed with Mr. Hamilton, that whenever sheep suffered from disease the wool also suffered; and he understood that when sheep were not sufficiently fed the same result was produced. What he had said with regard to the wool was founded on statements made to him by Mr. Joseph Henderson and Mr. Baker of Natal.

The following Paper was taken as read:—

2. *A Visit to Lord Howe Island.* By ALFRED T. CORRIE CORRIE, Surgeon, R.N.*

On the 16th of March, 1876, a fine autumnal day in the southern hemisphere, we sailed out of Sydney harbour—that harbour about which much has deservedly been written, and which is, I suppose, one of the finest in the world.

On the 21st, at 5 P.M., having made a very fair passage under canvas, we anchored off Lord Howe Island on the south-west side. The following morning, not being satisfied with our position, we weighed anchor at 9.30 A.M., and proceeded under steam to the N.E. roadstead, and anchored in 13 fath. Lord Howe Island is the southernmost of the outlying islands off the East Coast of Australia, in lat. $31^{\circ} 36' S.$; long. $159^{\circ} 5' E.$ It was discovered by Lieut. Henry Ball, then in command of his Majesty's ship *Supply*, on the 17th of February, 1788, while on a voyage to Norfolk Island from Port Jackson (New South Wales). He named the island after the hero of the "glorious 1st of June," the Right Hon. Lord Howe. It is some 400 miles N.E. from Sydney, and about 300 miles E. from the nearest land, Port Macquarie (New South Wales), and about 500 miles from Norfolk Island; of a somewhat peculiar shape, an irregular curve trending rather to the eastward, it is about 6 or 7 miles in length, and 2 or 3 miles in width in the widest part. On the east side are a number of bays, and the west is protected by a coral-reef in which are 3 or 4 passages for boats, and between it and the shore are shallow lagoons.

Off the north end of the island are the Admiralty Islets, about 2 miles distant; on the east side nearer the shore are the Sugar Loaf and Mutton Bird Islands; and on the west is Goat Island. Some 12 or 13 miles from Lord Howe Island is plainly seen a very strange-looking peak, called Ball's Pyramid, estimated to be 1800 feet high. The island is mountainous; the highest parts of the land are Mount Gower, rising from the south end at an elevation of some 2800 feet, and Mount Lidgbird some 2400 feet.

* Communicated by the author, by permission of the Lords Commissioners of the Admiralty.

The geological formation of the volcanic island appears to be disintegrated trap-rock and coral. The soil in parts is very rich indeed, and covered with dense vegetation, the undergrowth being kept comparatively clear by the goats and pigs; the grasses are couch and tuft grass. Four kinds of palms are found on the island, some reaching a great height, the Thatch-palm (so called by the settlers because they use it to thatch their houses), the Cabbage and Umbrella Palms. The Pandanus or Screw-pine (*Pandanus Forsteri*), located chiefly on the mountain-sides, attains a height of some 30 or 40 feet. It is called by the inhabitants the "Tent-tree," on account of the strange arrangement of its roots, which take their rise from the main trunk at different heights, and gradually extend forwards and downwards, and become fixed in the ground, forming a rough sort of tent.

The most conspicuous tree on the island is, perhaps, a species of *Ficus*, a gigantic banyan, attaining a great height, and spreading out its branches in all directions, which fall in a most graceful manner, covering large spaces of ground.

My friend, Mr. Moore, of the Botanic Gardens, Sydney, writes thus of it:—"The most remarkable plant, however, upon the island is a species of *Ficus*, the only one of the genus found there along the whole extent of the flat and richest ground on the south-west side. This noble tree grows in large numbers, very rarely in exposed situations. It possesses to an extraordinary degree the branch-rooting characteristics of the famous "Banyan" of India (*Ficus Indica*). From its high, wide-spreading branches adventitious roots are produced, which descend to the ground, then rapidly enlarge, and become in course of time huge stems, drawing nourishment from the earth for the support and increase of the parent-branch, which, as it extends, produces similar root-stems. This interesting tree appears to be new, and confined to the island, its column-like stems suggesting the specific name *columnaris*, proposed to be given to it."

The Lichens, Fungi, Algæ, and Filices, are numerous, especially the latter, represented by *Trichomanes*, *Asplenium*, two or three species of *Polypodium*, and a few others.

A few parasitical plants were noticed, and a strange kind of plant, called by the settlers the "Stink-plant," was pointed out to us; a most appropriate name, for, when its leaves are bruised or its branches broken, it emits a most sickening and offensive odour.

The fruit-trees and culinary vegetables growing on the island (all introduced) are oranges, water-melons, pomegranates, onions, potatoes, Indian corn, pumpkins, and tobacco.

Dr. Foulis, in a Report on Lord Howe Island, some years since, states that wheat grew well the three years he resided upon the island, the banana grew luxuriantly and ripened well; and that vines, which he planted on arriving at the island, flourished exceedingly well, and were producing fruit before he left.*

The animals are both indigenous and introduced. All the mammalia have been introduced, comprising a large number of pigs (both wild and tame), goats, dogs, horses, cattle, cats (both wild and tame), a number of mice, but no rats.

The Aves are represented by the common fowl (*Gallus domesticus*), ducks, pigeons, parroquets, magpies, doves, and mutton birds (puffins), so called by the islanders. The settlers obtain a dark-coloured oil from this bird, which is used to burn in lamps when whale-oil is not procurable, and occasionally the flesh is eaten.

Dr. Foulis in his Report, before alluded to, states that eagles have been known to visit the island. No Reptilia are seen on the island, not even a lizard; and I was informed by the settlers that neither snakes nor lizards of any kind were ever seen. Occasionally, I believe, water-snakes with black and white stripes, which are common around most of the islands in the South Pacific, are noticed near the reefs on the west side.

The Islanders at times are able to obtain fish in great abundance, mullet, guard-fish, rock-cod, and a kind of salmon; sharks are numerous; cuttle-fish and squids are occasionally seen, and some of the Cetacea or whale-tribe are in the habit of breeding near the island. Land-shells are found in large numbers, but in no very great variety: one honest fellow brought me off the morning we left about seventy or eighty, carefully tied up. When I opened this parcel that I had congratulated myself on being full of a variety of valuable shells, I found them all of one kind (*Bulimus*). Two or three species of helix are found on the island. Among the Crustacea may be named the crab and the barnacle.

The prevailing winds are said to be during the summer months from the N.E., and in the winter from the S.W.; severe westerly gales are experienced during the winter months, generally from May to September. These winds exercise a most destructive influence over the vegetation of the island, causing the crops to wither away; the only protection the settlers have against them for their crops, &c., are the large belts of trees found in many parts.

Not a thermometer, barometer, or meteorological instrument of any description was seen on the island; the average range of temperature on board our ship the short time we were there was:—Therm., max. 76°, min. 68°. Bar. max. 30.30, min. 30.09.

Dr. Foulis writes, "In the heat of summer the thermometer seldom ranges higher than 80° , nor in winter lower than 50° ; and I am of opinion that, owing to this great equality of temperature it would be difficult to find a more healthy spot for European constitutions."

Much rain falls during the year, causing the water to run down in torrents from the hill-tops; these are noticed chiefly in the months of May, June and July. Dr. Foulis saw the gardens and flats flooded once during his three years' residence on the island. The average rise and fall of the tides is some 5 or 6 feet; at times they are very low indeed.

The total number of people living on this romantic little spot is forty, including men, women and children.

Some forty-two years since, Mr. White, who visited the island to survey it, states that there were only four men, three New Zealand women, and two children living then on the island.

In 1853, Captain Denham found the number of people residing on the island comprised a little community of sixteen.

They are most primitive and simple-minded in all their ideas; one old lady, Mrs. Andrews, has been on the island thirty years; has one daughter married, and five grandchildren. She has, she told me, enjoyed excellent health the whole time she has been there; and was most cheerful and happy.

They all appear to lead very moral lives, and bickerings and open quarrels of all kinds are most unusual among them, and distasteful to them: there is one old man in their community, a retired whaler captain, to whom they refer all disputed questions, and whose opinion they regard with every feeling of respect, and whose decision is generally final. You can at once imagine how delighted they all are when a man-of-war or vessel of any kind visits them. Sometimes they are six and even twelve months without a ship of any description anchoring off their island; they told us that it was more than five years since a man-of-war had visited them.

When we landed, a number of the islanders came to meet us; it was quite a red-letter day with them: all turned out in holiday attire, and this quiet, isolated, but picturesque little spot in the centre of the South Pacific Ocean became quite festive and gay.

I regret to say we found some of them almost in a state of starvation: vessels from New Caledonia and Sydney, which were in the habit of calling, had failed to do so for some months. Their produce, onions, potatoes, &c., &c., which they give in exchange for tea, sugar, salt, clothing, &c., was completely rotting in their store-houses.

Their principal articles of diet are pork, fish, fowls, onions, potatoes, &c., which they have around them, and anything they are able to procure from passing vessels.

I am glad to state we were able to assist them a little by sending on shore tea, sugar, biscuit, soap, &c., subscribed for by the officers of the ship I was on board. My old friend Mrs. Andrews told me, with a very sorrowful countenance, that she had not tasted a cup of her favourite beverage, tea, for many weeks. The supply of water on the island is abundant and pure.

Their chief amusement is hunting the wild pigs, and is a great source of sport to the men.

One of the first things you are struck with on landing is the number of ferocious-looking dogs seen about, some chained and others loose; they are of various crosses. Those that are loose, although they have a most fierce look, are really extremely docile: these are the "hunters;" others that are secured are more of the bull-dog type, and are called the "holders."

None of us had the good fortune to take part in or see a pig-hunt; my friend Mr. Hill, of Sydney, describes it thus:—

"The pig-hunter has at least three dogs—two 'finders' and one 'holder.'

"The finders seek for and bring the pig to bay; the hunter is guided by their cry and hastens to the spot, having the holder, generally a coarse bull-terrier, in leash.

"When near enough the holder is slipped, and at once, at the risk of being torn open should it be a boar, or severely bitten if a sow, it takes hold of the pig by the ear; one of the other dogs then, if good, sometimes seizes the other ear. This is the moment for the hunter, who, watching his opportunity, rushes in, and taking the animal by a leg, overturns it, and planting his foot on its neck, the moment he can make his dogs let go, plunges his knife into the throat, and the hunt is over."

The chief danger to the hunter appears to be in the dog not being able to hold on long enough or letting go before the hunter is quite ready for sticking his victim; of course, if the animal is quick enough, and able to turn on his pursuer, he may inflict most serious injury on him.

They occasionally play a rough game of cricket, and in the evenings an American game of cards, called "Euchre."

All appear to enjoy good health. The men, who are of the seafaring class generally, and have been much exposed during their lives, suffer occasionally from rheumatism; and epidemics of influenza occur among them. They have no medicine-chest on the

island, having to treat one another the best way they can with a dose of something whose active ingredient is Epsom salts or such like.

There is no general cemetery on the island; they bury their relatives in isolated little spots of ground selected by themselves. Their observance of the Sabbath consists in suspension from all games and labour, but there are no religious services of any kind.

It is to be much regretted that some of the Colonial dignitaries of the Church do not visit the island and consecrate a piece of ground where they may bury their deceased friends and relatives—I know that they desire it much; many of them spoke to me on the subject—and also endeavour to establish some form of religion among them, and some further observance of the seventh day than mere suspension from work and every-day amusements. They possess but few books; the small library they had was burnt some two or three years since.

There are fifteen dwelling-houses on the island besides granaries and piggeries, all built, with few exceptions, of that Thatch-palm before alluded to; and one or two, that are less primitive and more durable, are raised on stone blocks and boarded up with some Australian pine, painted, and roofed with galvanised iron. The entrance door is in the centre of a fair-sized room, the sitting-room; the sleeping apartments are at either end; there is no fire-place; the kitchen is formed of one room or compartment a few yards from the house, with a fireplace at one end, and a sort of larder at the other; they take their meals here generally. Their houses are kept very clean, and are certainly very cool and comfortable.

The number of acres at present under cultivation is about 40 or 50, and some 150 to 200 under grass. The families each cultivate their 4 to 6 acres; growing potatoes, onions, maize, tobacco, &c. No doubt 300 or 400 people might live comfortably on the island, provided they were able to get rid of their produce.

In former days whalers used to call every week at the island. Dr. Foulis writes:—

“Howe Island has for many years been a place of resort for whalers to procure wood, water, and fresh provisions, to enable them to prosecute their voyage without the necessity of going into port. There were generally from sixty to eighty vessels in the course of the year that touched there for the above purpose; it not unfrequently happened that we had English news from American vessels some weeks before the same was known in this Colony” (New South Wales).

But now this once much frequented and favoured little spot is apparently quite deserted; the old families have lost all zeal for cultivation, having to live as it were from hand to mouth, see the fruits of their labours decaying and rotting in their store-houses. One cannot help pitying them sincerely; they are naturally now so attached to one another, being in reality but one large family, and having lived such quiet and peaceable lives so long together, that I suppose many of them would rather die of inanition than leave the spot.

I imagine that sheep would thrive well on the island: the difficulty again would be in disposing of them. The question was mooted some years since as to the advisability of doing away with their "holders," and keeping sheep: the general opinion, however, was that it would be impossible to keep the wild dogs and sheep together, and that it would be more to the advantage of the islanders to retain their canine animals, and trust to their wild and tame pigs for animal food to a very great extent.

The heads of cattle they have on the island are at the present time thriving well.

As to the early history of this quiet little spot, it is wrapped in much mystery. Somewhere about the year 1834 three men are said to have gone there with Maorie women: they remained on the island a few years, but, finding they were unable to make any money there, they left.

Some thirty to thirty-five years since, Dr. Foulis settled on the island with his wife and family, and remained three years.

My old friend Mrs. Andrews, who is about seventy years of age, told me she came to the island about the same time that Dr. Foulis did; she is the oldest inhabitant. Her husband, an old whaler by profession, died six years since of cancer, and is buried on the island.

Whalers calling from time to time often used to leave their families on the island for a short period, and then take them away again, but a few remained altogether; and so the little community has been augmented until it has reached its present number of settlers, viz. 40.

It is but just, before concluding this article, that I should state that, during the few days I spent with the people of Howe Island, I thoroughly enjoyed their kind and simple manners, which were most winning; their extreme gratitude for any little attention or kindness was most marked and gratifying; and I feel quite confident, had I, or any of my shipmates, been left behind by accident or otherwise, we should have experienced on all sides from the

islanders the greatest possible kindness. How could one fail to be happy in such a cheerful, kind-hearted, and well-organised little community?

Sixth Meeting, Thursday, 7th February, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

The Meeting of the Society on the present occasion was held in ST. JAMES'S HALL, on Thursday the 7th, in lieu of the ordinary Evening Meeting of Monday the 11th; the arrangements being in accordance with Rule 6, Section 3, chapter v., of the Regulations governing Meetings of exceptional interest. H.R.H. the Prince of Wales and other distinguished visitors were present. The subject of the evening was a Lecture, "On his recent Explorations and Discoveries in Central Africa," by H. M. Stanley.

The PRESIDENT, in introducing the subject, said, upon the last occasion when the Royal Geographical Society held a Meeting in that Hall, they came to listen to a narrative, from the leaders of the Arctic Expedition, of the perils and trials which they had undergone with the resolution and courage that were always expected from English sailors. The picture of the Polar Regions which was then presented to them could not have been forgotten by those who were present—the picture of those eternal wastes of snow; of navigation through the Polar seas; of the movement of the icy floes, between whose clip the greatest iron-clad in the world would crack like a nutshell; of the long night which counted months, and a temperature which sometimes descended 70° below zero. The Meeting followed the track of the sledging parties over that ever-frozen sea, and the hummocky ice, when two miles a day was considered a good day's journey, numbed with cold. Nor could they have forgotten that heroic walk of Lieutenant Parr, who, when his comrades were stricken down, and nothing but death was before them unless some rescue could be obtained, started, with his alpen-stock and some frozen bread, for a 30 miles' solitary walk to the ship. That was one of the most heroic walks of which there was any record; when blinded with snow and numbed with cold, his resolution never failed. The present Meeting was called to hear the narrative of another great explorer, but they would be transported to a very different scene. The order of the poet, from "Indus to the Pole," would be reversed. They would come back from the Pole to Afric's scorching plains; and contrast could scarcely be greater. What could man's powers do amid the great icebergs of the frozen seas? Human beings were helpless against such gigantic forces of nature; while in Central Africa other forces of nature, not less terrible in their course, had to be encountered. There the sun, with direct rays that scorched the brain and consumed with heat and thirst those who were not born under its influence, had to be endured instead of the Ice King and his wastes of snow. There the progress of the explorer was opposed, too, by the animosity of man. Africa, the home of the lion, the elephant, the rhinoceros, and a thousand other forms of animal life, instinct with destructive power, was also a land of savage tribes infinitely more dangerous than the wild beasts of the jungle. The Society would now hear from

one who had just returned from such scenes, what trials and perils hourly and daily he went through for three long years, for the advancement of Geographical knowledge, and for higher and greater objects, the opening of this great continent to civilisation and Christianity. The traveller whom he now had to introduce to the Meeting was no stranger. He was already well known to them, and both the Royal Geographical Society and the nation owed him a debt of gratitude as the deliverer of Livingstone. His first expedition was for the purpose of finding and relieving that pioneer of all recent African exploration. Mr. Stanley received in the middle of the night an order, to "Go and find Livingstone!" "Where is he?" "We do not know—somewhere in Africa: you must go and find him." And he did find him. The Geographical Society at that moment was fitting out two expeditions, one from the East and the other from the West Coast, intensely anxious to rescue Livingstone, if alive, of whom they had no authentic intelligence for two years; but in the meantime an explorer appeared with whom the Society had nothing to do, but who was told to go and find Livingstone, and he went straight on and found him. That was a feat which might have sufficed for a man's life, but Mr. Stanley had spent three years on a second expedition. He had come fresh from the Congo, which could now be traced from its sources through 2000 miles of its course. He had no intention to detain the Meeting which had come to hear Mr. Stanley, but he thought it necessary and right to make these prefatory remarks, that the Meeting might know what he had been doing during the last three years, through what constant peril and danger and trial he had passed, with a resolute spirit that never quailed, so that he now ranked among the first class of great explorers. His discoveries on the Congo were not exceeded in interest even by the discovery of the sources of the Nile. Mr. Stanley's object in attending the Meeting was to give an account of his explorations, and on his way from Cairo he had already received a welcome which the Royal Geographical Society desired to repeat. At Cairo, Rome, Marseilles, Paris, he had received all the honours that could be heaped upon him from sovereigns and Governments, and the two Houses of Congress in his own country had passed a unanimous vote of thanks to him. He was certain that the Royal Geographical Society would not be backward in rendering the due meed of praise to the great explorer who came with fruits of discovery which would benefit the whole world.

On his recent Explorations and Discoveries in Central Africa.

By H. M. STANLEY.

Mr. STANLEY spoke as follows:—

Mr. President, your Royal Highness, Ladies, and Gentlemen,—If there is any informality in my Address this evening, please address yourselves to Sir Rutherford, and ask him for the explanation; if there is any *impromptu* rendering of the story of an explorer across the dark continent, I must ask you to address yourselves to the Royal Geographical Society. Had I my wish to do fitting honour to the Royal Geographical Society, why I should like to spend a century in describing, in order to give a vivid and reasonably correct idea of the march across the sad continent; but Sir Rutherford, in the name of the Royal Geographical Society, tells me, in a very courteous tone, that you have gathered together

simply to do me honour. He tells me, and Sir Henry Rawlinson also whispers in my ear, that you do not feel inclined to-night to listen to anything verging on the strictly scientific. You have come here to hear what concerns manhood; you have come here to hear what concerns humanity; you have come here to hear what concerns the opening of that closed and lost continent; and responding to what Sir Rutherford and Sir Henry, who know the tastes of the Society, have whispered in my ear so kindly, I come to render you a story something similar to what, had you and I met before a Central African camp-fire, I would have given you. Besides, I really have not had time to put down anything in writing, nor to respond to a thousandth part of the letters that come to my house. I have been so busy from morning till night that I have sighed, ah! such long-drawn sighs, and would fain be in Africa once more in order to be relieved from the necessity of writing letters—"I have the honour to be your most obedient"—"Believe me, yours very sincerely"—and all sorts of things of that kind. We do not do such things in Africa. I have heard of an explorer, who, after he came from Africa, was asked by one of those Englishmen who believe in the soft, sentimental, sugar-and-honey, milk-and-water kind of talk, "My dear Sir, will you kindly tell me how you treated the Africans in Central Africa?" "My dear Sir," said the suave explorer, "I treated them like a gentleman." Heavens! I should like to know how that explorer managed to treat the Central Africans like a gentleman. It is only under circumstances like these that I feel inclined to treat people like gentlemen. When they have responded to the invitation of Sir Rutherford Alcock and Sir Henry Rawlinson, and the other *savants* of the Royal Geographical Society, to do honour to the explorer, why then the explorer should open his heart and say, "Look, my heart is big, extends right up to my throat; it beats so fast and spontaneously to you who have come here."

Sir Rutherford, your Royal Highness, Ladies, and Gentlemen,—I am not going to waste your time, for Sir Rutherford kindly tells me that I have just got an hour, and I want to see if I can interest you in anything concerning Africa. I shall tell my story briefly and rapidly. At the same time I must beg you to understand that it would be but mere affectation in me to pretend not to know that there are some here who do not quite agree with my treatment of the African. However, if there is any one here whose susceptibilities have been shocked, I should like to see him stand up, so that I may measure him and see what he is made of. I flatter myself I have a little gift of measuring human nature—cer-

tainly I have had plenty of chances of studying it—white and black. There are very few parts of this very small globe that I have not been in, and it is no matter of boast at all for me to tell you that in the character of a “special correspondent” my duty has been specially to study human nature, and I attribute my success across Africa to having been trained first of all as a journalist and as a man specially dedicated to the study of human nature. Should I meet a charitably-disposed person, what ought I to say to him but—“Why, my dear gentleman, I shall be just as charitably disposed as you”? My ears are open; I listen to his sentiments. If I hear a person disposed to take the military view of a situation, why I am quite at his mercy; I shall sit at his feet like at the feet of a Gamaliel of old, and I shall ask him, “Can you, please, instruct me in military tactics?” Should I meet an explorer, like Baker or Grant, why, I shall ask him, “Can you give me any wrinkles about how to explore Africa?” Should I meet a missionary, I will ask him, “Look here, when you want to go and propagandise, will you kindly tell me how you dispose of yourself, with that sentimental, soft attitude? Is it necessary to have any special mode of behaviour? If so, permit me; I am a very willing pupil of yours.” If I meet a special war correspondent of note, I will ask him, “How do you take those notes? How can you manage to take that pencil and dot off in short, sharp, shorthand, everything that a man speaks?” and I shall be delighted to listen to him. But when I am commissioned not only to act as a special correspondent, but as a missionary and as an explorer, I am bound to be a sort of cosmopolitan, and a man who has been studying all things; at least, if I have not studied them, I must pretend to know them; and when did you ever see a special correspondent with that modesty which professes to know nothing? Why, it is part of his nature to profess to know everything, and I do not believe I shall shock you, since you have heard it a great many times, when I say that my profession is one which studies everything. It has been said, I believe, in a certain journal, which you might almost call anti-Stanley, that Mr. Stanley has been civilising negroes with explosive shells. It has been said, also, that he is a belligerent kind of person; that he has been shutting up the continent, instead of opening it. I ask you, in one word, not to believe any such kind of thing. It is all nonsense, I assure you. I am willing to make an elaborate defence of myself, and such explanations as the keenest of you may desire I promise to interpolate in what I will say to-night.

Zanzibar is, of course, the place from which travellers bound

for East Central Africa start. It is a place of no great account in itself, being only an island, 45 miles long by about 15 miles average width. It is interesting to the explorer as the point where he organises his forces. As you send your favourite emissaries through the streets and alleys of Zanzibar to hunt up recruits for the Exploring Expedition, a great many comical incidents naturally take place. I had a great many, though I came with a very favourable reputation. The people who had been in the search after Livingstone spread abroad the word that "the white man with the open hand" had come back to Zanzibar. "The white man with the open hand" was echoed through the streets of Zanzibar. "The white man with the open hand!" What kind of a man is that? Is that a man who goes all about the country with his hands wide open? Oh, no; he is the man that throws his money right and left. "And where is he?" "Oh, he is at Shangani Point." "Ah! shall we go and see him?" "Yes." They go to the bazaars of Zanzibar, and they say, "The white man with the open hand is come; let us go and see him." Of course their cupidity, their avarice, is excited, and they are very anxious to see him, and so I am suddenly surprised by fifty or sixty men coming to see me, and the oldest of them come and ask me, "Master, are you the one who went after that old white man who was said to have been lost in the far interior?" "Yes, I am." "Ah, and what man are you after now?" "I am not after any man this time." "Ah, and what are you after now?" "I am after rivers and lakes and mountains, and trees and forests; I am after tribes and nations and races; aye, and I am after to cleave, as it were, the continent." "Mother, mother, mother! do you mean to say that you are about to do all this?" "Certainly." "Do you know how many years it will take you?" "Not I. I do not care either." "Well, you know who we are; we have fathers and we have mothers, and we have brothers, and we have sisters, and we have children, and then we have got coco-nuts, and we have got bananas, and they must be thought of." "Well, I suppose you want to ask how much time we will employ in it. You know the rate of marching I did when I went after that white man in Ujiji. Well, now I will cut like an arrow across the country. You say I did a considerable march when I went after that old man. I will surprise you this time." They said, "Well, you know it takes so many years to Uganda, and it takes so many years to Ujiji, and so many years to Nyangwe. By the time we have finished going across the whole country—it extends away, away, away—there is no end to it—how many years will it take you? Even your children will not see the end of it."

"Well, consider how many camps there are between here and the lakes; consider how many camps there are between lake and lake; consider how many camps there are between the very furthest point that the Arabs have reached on Lake Tanganyika and the end of all, that is Nyangwe. Well, so many camps mean so many days. Supposing, for instance, that you allow for contingencies; that after going four days' march you rest one day; why, then it will only add so many days." "Ah, yes, that is true; and how much will you give us, master?" "How much will I give you? How much would you like?" "Well, you know how much you gave us last time—don't you?" "Yes. How much do you want this time? That is the question." "Well, you gave us three dollars a month." "If you are strong and brave and good I do not mind it. Three dollars let it be." Well, from 150 to 200 came and signed their names for three dollars a month. Four or five days after, they found I was a little more liberal with my money than they had expected, and all in a body asked five dollars. They said, "That other white man who went before you into Africa gave us five dollars, and you must give it." "Well, all right; if that other white man gave you five dollars, I do not mind giving you five dollars also." So we agreed. Well, when I came to muster all the party that had signed for five dollars, I found that I had a most extraordinary lot. There were the tall fellows, the short fellows, the lank fellows, and the fat fellows; there were fellows who owned one slave, there were fellows who owned five slaves, and they had all come to sign their names, and there were some fellows who boasted of having murdered people—very rough fellows. I asked one of them, who had been boasting of having murdered eight people, "How do you suppose you will get along with me? Do you really think that I will engage people to be murdered by you on the road? How many people do you think that you can murder with my eye on you?" "I do not know, master." "Now mark my words, my friend: take care you do not murder one in my expedition, otherwise I will come down on you like a thousand of bricks." "I believe you, master," he said. I said, "I tell you there will be an eye on you from the day you leave this island to the day you come back, and I will take my solemn oath that you won't murder one man, my friend: I will take another oath also, that by the time you come back to Zanzibar you will be a ten thousand times better fellow than you are now." What could the man do? All he could do was to bow. So the day came when we parted from Zanzibar in a perfect fleet for the East Coast of Africa.

The East Coast of Africa is so much talked about, so well written,

so well described by Burton and Speke, by Speke and Grant, by myself after the first expedition in search of Livingstone, by Cameron afterwards, and by those missionaries who have followed in the track, that it is not worth while for me to go at it. However, imagine that the same incidents, the same scenes, the same daily routine of business and of life, take place until we come to a place (Unyanyembe), where I must cut adrift from the old-fashioned route, and strike towards Lake Victoria. My first introduction to that virgin region was to a tall, swarthy prince, who came to me almost naked. He came to me in that unaffected, perfectly natural tone, that wins its way to a man's heart, if he has any softness or tenderness at all. He said, "You are the first white man I have seen." "Ah, then, I ought to be big white man, if that is the case." "Are there many more like you in your country?" "My dear friend, could you only go with me to the time when I shall go back, and be introduced to a certain Society called the Geographical Society, I should perfectly swamp you: you would see such a number of white faces that you would say, 'Oh, it was like a sea.' That is the only description I can give you. You call all things great in your country a plain. We have got things greater than plains. We have got seas; we have got oceans; and were I to show you all the white faces in the world, why, you would say that every grass-blade and leaf in Africa would not equal the number." All he could answer was, "Mother, mother, mother! what lies this fellow tells me!" I find that whether I go into Africa, or whether I go into England, or whether I go into America, everything extraordinary is called lying. I would specially ask you, ladies and gentlemen, if you desire to be cultivated, or to be considered more intelligent than the average of people, never to say anything absurd or vulgar; and never tell a man what he will consider a lie. I have instructed those Africans over and over again, and I cannot help taking this advantage of instructing you also. We swore eternal brotherhood; and finally I left Ugogo, and came to the jungles which separate Urimi from Ugogo.

In Urimi we are on the south-west corner of the Masai, a tribe that specially delights in blood. The Arabs say that they have great trouble in going anywhere near the Masai. I fancy they are something like the Comanches, or the Apaches, or the Arapahoes of our country. They are a warlike people; and if there are any ladies or gentlemen in this Society this evening who are specially ambitious of becoming martyrs, I do not know in all my list of travels where you could become martyrs so quickly as in Masai. I, on the other hand, was not ambitious of becoming a

martyr: in fact, I do believe that such a meeting as this repays me for all the trouble I have gone through, and how could I have enjoyed it had I left my bones to bleach upon the plains of Urimi? How could I have become almost intoxicated with triumph at seeing your welcome faces to-night, had I left my grinning skull bleaching upon the plains of Urimi? Yet have we such ghastly objects as skulls and skeletons. You see them daily; and you are warned by them. There is but a step between you and death. We came to Suna in Urimi. I never saw such a suspicious lot in all my life. It has been said by some novelist, I forget his name, that the English policemen are the most suspicious people in the world; and yet they cannot give you an idea at all of the suspicious looks of those gentlemen of Suna. They eyed me up and down and all over. They made dead sets at every hair in my head; they counted every hair in my moustache, and they seemed to think that every hair in my head and every hair in my beard was arrayed against them for the purpose of stealing their corn. But having practiced diplomacy with the Waha in the old days, I put my powers of diplomacy to a very good use, and I persuaded them; but such an amount of persuasion! If it was faithfully recorded it would fill all the volumes in a very respectable library. I told them, "My dear friends, my dear dark brothers, do not look at us so dreadfully suspicious: you cannot imagine how much we love you; we love you so much that we could just hug you to our hearts. Won't you believe it? What is it you want? Name it. Do you want a necklace of beads? Do you want a string of cowrie shells? I will give them to you. I brought them for the special purpose of giving them to you. Do you want an old tin pot? I have got lots of them. Do you want an exhausted sardine-can? Do you want an empty soup and bouilli-tin? Why, gracious me, take it. I want to show you how extraordinarily liberal I am. Take everything; but do not look at me with such ferocious and suspicious eyes." Well, the sacrifice of a great many soup and bouillitins, and the free giving of any number of exhausted sardine-cans, satisfied them for two or three days; but it could not last for ever. I could not empty all my sardine-boxes to give to them, and finally we came to a standstill. What else could I give? I had no old stockings, or old shoes, or old clothes, or anything of that kind: they were all new, so far. We came to a standstill. At last I found a box of Palmer's biscuits. "Take that, consider that an enormous present." They took that, and were perfectly satisfied. That was to the magic Doctor, and he swore eternal brotherhood with me, and said, "If there is anything in the world you want from

me, I am willing to give it." After making marks in each other's arms and exchanging blood, there was a treaty of peace as firm, I thought, as any treaty of peace made in Europe. However, like treaties of peace in civilised lands, this treaty of peace was soon broken. I heard war-cries outside. "Good gracious me! why, I have just signed the treaty of peace, and have taken the blood-pledge. I do not believe it. Go and see what is the matter." At last one of my young men is killed, and another is coming to the camp, and he has got two spears in his arm, and an arrow in another arm. "Bring him in." He comes in. "How is this, my dear Soudi? Where have you been?" "Master, I was in the woods collecting fuel to cook my rice, and some of the savages surrounded me, and I had no weapons. A stick was thrown at my head. I fell down, but I picked myself up and rushed to camp, and had two spears thrown at me." "You don't say so! That is very strange. I made a treaty of peace just now." "Yes, master." "Call the chiefs; muster the people; see what is the matter." They all come. "What shall we do! What is to be done? It is very bad." "It is very bad, master. One of your young men is killed. Here is another one, won't you believe it? with his wounds still fresh. What will you do?" "Well, wait a while. Open the ammunition-boxes: give twenty rounds of cartridges to each man, and get your axes ready; and as we sally out of the camp, you make a brush-fence all round, three or four feet thick. Pile on the wood. Look after the women and children. Allow none of the weak men to go out, and we will clear these parties." We waited until the arrows fell in the camp. Then we sallied out, and, after clearing the outskirts of the camp, we waited a day, and the next morning they came again. We had to clear them again. The third day they came again at nine o'clock. They would not fight before nine. I said, "These fellows really mean war; they do not merely mean coming to scare us. Ah, we will give it to them this time;" and I am happy to say we did not leave that place until we had perfectly sickened them. I believe that was the first time those gentlemen of Urimi were perfectly settled. By the by, I am reminded of what I have seen in the 'Church Mission Record,' or something of the kind, of a Church Mission party having gone to Uganda, and they say that on the road they never heard anything about it. Ah, I wonder if they mean to insinuate that they were all killed, or what? I am really curious to know. My idea is that they never went near them; but, if they did, then they are indebted to me, and I am not at all surprised—not a bit.

From Urimi we went on to Lake Victoria, a straight and direct

road. On the frontier of Usakuma we were welcomed. They asked if we had fought with those fellows of Urimi. "Ah! they are a bad people; we cannot go anywhere to carry a tusk of ivory to get cloth from the sea, but what those people attack us: but you are welcome;" and whatever of their flocks and herds they could give me to show me welcome they did give me, I am happy to say, and through their large kindness and charity we came at last to Lake Victoria.

Lake Victoria, before I went into Africa, was described by Livingstone as consisting of five lakes. A great many Fellows of this Society also who are now present in this Hall, I dare say, believed with Livingstone; but there was one, Captain John Hanning Speke, who first discovered the Lake, and who, with his attribute of genius, drew a bold outline of the Lake, and though I spent fifty-seven days in tracing the coast, there are not very many miles to be taken off from what he drew. You know very well that Captain Speke not only discovered Lake Victoria, but he also discovered Uganda. M'tesa is the emperor. Now I do not know what Speke's special ambition was, but I would just as soon have discovered Lake Victoria and M'tesa, the amiable Emperor of Uganda, as have discovered the course of the Congo: in fact, I envy him that. I wish he had left me it to do. It is the only thing I really envy in Speke, that he saw Lake Victoria first and such a really good amiable man as M'tesa. As I told you before, I flatter myself that I can study human nature, and that when there is anything of value in that human nature my instinct will tell me. When I came to M'tesa I recognised it, and the effect of that intercourse with M'tesa was that I sent home this account. It is very briefly described here. "I have indeed undermined Islamism so much here that M'tesa has determined henceforth to observe the Christian Sabbath as well as the Moslem Sabbath, and the great chiefs of Uganda have consented to this. He has further caused the 'Ten Commandments' to be written on a board for his daily perusal, for M'tesa can read Arabic, as well as 'The Lord's Prayer,' and the golden commandment of our Saviour, 'Thou shalt love thy neighbour as thyself.' This is great progress for the few days that I have remained with him; and though I am no missionary, I begin to think that I may become one if such success is feasible; but oh, that some pious, practical missionary would come here, what a field and a harvest ripe for the sickle of civilisation! M'tesa would give him everything that he desired—houses, lands, cattle, ivory; he might call a province his own in one day. It is not the mere preacher, however, that is wanted. The bishops of Great Britain

collected, and all the classic youth of Oxford and Cambridge, would effect nothing by mere talk with the intelligent people of Uganda. It is the practical Christian teacher, who can teach the people to become Christians, cure their diseases, construct dwellings, understand and exemplify agriculture, and turn his hand to anything like a sailor. This is the man who is wanted. Such an one, if he can be found, would be the saviour of Africa. He must be tied to no church or sect. He must profess God, His Son, and the moral law, and live a blameless Christian, inspired by liberal principles, with charity to all men and devout faith in Heaven. He must belong to no nation in particular, but to the entire white race." That is the man that is wanted in Africa. Now you see what an exceedingly charitable man I was to ask for such a man. I do not profess to call myself a missionary at all, but wherever I see goodness I will adore it, wherever I see piety I shall respect it; if I see a disposition to be amiable, then I shall be twice as much more amiable. But see how I am treated; just listen to the few words that I will read to you, in order that you may see what a vast immeasurable distance lies between the real explorer and what you might call the pious missionary. "Then Lukongeh mentioned Bwana Americani, as they call Stanley. I was very glad to find that he clearly understood that there was a difference of nationality between him and me, and I was not slow to increase this distinction, as far as he could comprehend it." Ah me! is that the man I asked for to go and teach M'tesa to become a Christian? Is that the man with the large charity, the noble soul that sees no distinctions in Christianity? Is this the man that I invited to come to Africa? Is this the man that I invited to follow my tracks? Is this the man that I asked to come and teach M'tesa the full purport of that glorious commandment, "Thou shalt love thy neighbour as thyself"? Must a man, in order to be called a Christian, always have his mouth filled with pious words? Can he not respect piety, can he not respect religion, can he not respect the Christian, without rant, without mock piety, without hypocrisy? M'tesa I found to be an interesting man, though Colonel Long and others pretend to doubt him, and call him wily. If there is anything in his nature it is his perfect frankness, could you only, as it were, draw out that frankness. Whatever there is of goodness in a man, try, by that art which you obtain by cultivation, to draw that goodness out; try, if you can, to suppress his natural wildness of character, and you may have any African, even the cannibal, subservient to you. It has been said that the African is incorrigible, that his barbarism is irredeemable. Not a bit of it. Even the wildest cannibal

who sang the death-song on the banks of the Livingstone, and said, "Oh, we are going to have meat to-day!"—even he may be saved. Perhaps you say that I am too sanguine. Not a bit of it. I fancy that if they have the gumption to like to eat man, they may have the gumption also to understand man, if they find man is made for something better than to be eaten.

After a long stay with M'tesa, and crossing over to Lake Albert, I started for Rumanika, that sweet gentle pagan, as I call him. I am sure you must have seen certain bishops in England who have the most perfect suavity, whose voices are really like drinking a fine old wine—so sweet! Well, so Rumanika was, and yet he was a pagan, but he was a natural-born gentleman. His voice was just as soft as a summer's dream, there was no jar, no discord in it. "And where do you come from, my friend?" "I come from the white man's lands across the sea." "Ah, and did you ever hear of Rumanika?" "Ah, yes; don't you recollect that good old Speke was here, and did not he tell you about the white man's land, and must I tell you that I have come from there, and do not they send you any number of greetings? why, just as much as you could hear during a whole year." And Rumanika showed such ineffable pleasure in his face, he was so immeasurably pleased, that he wished the white man to come again. I found it much easier to Christianise M'tesa than to Christianise Rumanika. I could make him a geographer, but I could not make him a Christian. He assisted me with men; he gave me abundance to eat and abundance to drink. "Drink," he said; "drink not water, drink wine—wine of banana and plantain, oceans of kindness and oceans of friendship." What pancakes we had on the Alexandra Nile, going up as far as Karagwe! They told us fine old tales about the old King of Karagwe, the first king, and what fine fellows his sons were, and they said, "Do not we wish this country here to be filled with white men." I do not believe they knew what they were talking about.

After spending a very pleasant month in Karagwe, we came to Ujiji. My time is drawing to a close, and I must gallop over the rest. Ujiji, I am told, is the watering-place of explorers, but it was necessary for me to go there in order to follow up that which my predecessors had left undone.

After circumnavigating Lake Tanganyika, we crossed over to Nyangwe. Nyangwe was, as you may say, the *ultima thule*, before I went there, of all we knew concerning the Lualaba. It is a mere Arab depot on the right bank of that great river. The first few days I was there I often wondered how Livingstone had ever fancied that this river could be the Nile. Here was a mighty river,

with 124,000 cubic feet of water per second, while the maximum of the Nile does not exceed 550,000, and the minimum is about 25,000 cubic feet of water per second. How it could have been supposed for one moment that this river was the Nile I cannot imagine, but I fancy that Livingstone, after dwelling so long in that part of Africa, and not able to kindle his ideas by rubbing them against the ideas of other people, fell into that dreamy state which you may say distinguishes a man before his dissolution. Could he only have had daily papers, could he only have read the modern novel, could he only have heard the modern debate, how it would have sharpened him! He would have dropped the classic Nile at once; he would have dropped all idea of discovering the fountains of Herodotus and the Mountains of the Moon: for we are getting so thoroughly prosaic now, we do not care about classicisms, we do not care about anything the heroes of old said. We want what is to-day; we want the river, though it may be a new one which was never known before, that can float steamers; we want the banks of a river where we can grow cotton, where we can grow sugar-cane; we want the banks of a river that can support millions of men—let whatever there is of classicism come afterwards, but not before. Sentiment must only come behind the practical view of things; and had Livingstone only lived a month in England, and been set right down in the middle of the Royal Geographical Society, what an uncommonly live man he would have become, and how he would have been keener than ever to have followed that river to the sea! He would not have said, when writing to Sir Henry Rawlinson, who will correct me if I am wrong, “My dear Sir Henry, I am almost sure that I have discovered the fountains of the Nile. You know I would not be made black man’s meat for the Congo, or any other river less than the grand old Nile.” You see what the old explorer, worn out as he was, was dreaming about. But how far away he was! “Old master,” said Muinyi Makya, “what are you come here for? What are you doing here so many years?” And Bana Abdallah, as he told me the story, said that the old man just sat stock still, and, resting his chin on his hands, he said, “What did I come here for, did you ask? My friend, if I were to tell you, you would be just as ignorant then as you are now. If I told you that I came here to discover water, you would not believe me; if I told you I came here to do good for you, you would not believe me; you would laugh at me, and therefore it is just as well that I should remain silent.” It seemed to me as if I could divine what Livingstone’s thoughts were when he was asked those questions. “Well,” I said to Bana Abdallah,

"I have come here, my friend, to do what the old man was too old to do. Can you tell me which way this river goes?" "Oh yes," said he; "I can tell you all about it. Well, you see, you go from here one day's march, and then there is a cataract, and below the cataract there are any number of pools going 'r-r-r-r-h,' and then you go beyond that a little way, and you come to another cataract, and then at the bottom of that there are the roaring waters again." "Yes, but where does the river go to?" "It goes north." "North?" "Yes, north, north, north, and there is no end to it." "That is all you know about it? Did you ever hear of a man who knew the end of this river? That is what I want to find out. If you know of such an one, will you bring him to me?" "I know a man who has been very far; I do not know whether he has been to the end, but further than any of us." "Will you bring him to me?" He sent a boy to bring this man, and the man came, and he folded his hands together; "Master, you want to know all about this river?" "Yes: can you tell me all about it?" "Ah, I am your man." "What do you know about it?" "Well, I went with an Arab, the son of so and so, and I travelled upon the Lomami, and after going beyond the Lomami I came to a country at the outskirts of the country of the dwarfs, and I saw the river on my right still, going north and north and north, and there was no end of it." "Is that all you know about it?" Well, you know it goes north; what more do you want?" Perhaps I might ask you the same thing: perhaps I might say the river went north and north and north, but would that have satisfied the Royal Geographical Society? Supposing I said to Sir Rutherford Alcock or to Sir Henry Rawlinson, "I know all about this river: it goes north, Sir Henry; it goes north, Sir Rutherford; it goes north and north and north, and there is no end to it." Why, you would simply laugh; and yet we had a Geographical Society, I won't say a Royal Geographical Society, at Nyangwe. I was the President of it. I do not say it was as intelligent as this one, but it showed particular interest in that country. Why, as each new comer came and sat himself down under the eaves of that mud-hut in Nyangwe, and told the tale of what he had seen and what he had heard, there were just as interested listeners there as are here to night, because it was their own land, and there were traditions and legends and stories without end, excelling the 'Arabian Nights.' Some day, when I become an old man, with much grayer hair than I have now, how I shall love to sit under my own fig-tree and write the legends of Africa, and how interested ladies and gentlemen will be to read those legends as I heard them! Finally, after getting all the knowledge that could

be obtained orally from the Geographical Society of Nyangwe, I engaged the notorious Tipu Tipu. He said that for 2500 dollars he would take me so many camps, and then he would leave me, or I could come back with him. After the contract was signed, we first of all struck through the forest of Uregga, and you ought to have heard what the Nyangwe people said about the old forests; how the leopards would eat us; how the boa constrictors would come after us; how the wild snakes would fasten upon us; how the people would stand behind the tall trees with long spears and aim at us as we passed by, and how the poisoned arrows would hiss right in among us. We passed through the forest, however, safe enough, though it was very tiresome, wearisome work. You could not see the sun at all, except when you came to the small circular clearings. Then we got tired of the forest, and I saw that the Arabs were tiring out, and I said, "My friends, I see you are pretty tired of this forest; suppose we cling nearer to the river: that is the point I want." "All right." So we went to the river, and after a few days we arrived on the verge of the Cannibal lands. Now you must understand that from the day we left Ujiji the natives and the Arab traders had been telling my people what a terrific lot these cannibals were, and of course they were very much afraid and in deadly fear of that country, and it required all my influence and all my skill to prevent them giving way to despair. At last, on the 28th of December, 1876, the Arab escort parted from us. I took my people to an island, and after warning the chief of the Arab escort that if he allowed one man to run away there would be no chance of getting his money, he did his utmost to help me. Then the Arab escort, finding they were to return to Nyangwe, began to sing the song of farewell, and I thought it was time for me to exert the very last bit of influence I had on my people; so I ordered them into the canoes, and then I thought what the poet Tennyson would have said had he been there to address them, and though not exactly his exact words I used, still the pith of them may be found in the beautiful poem of 'Ulysses' by Tennyson,

"My followers—

Souls that have toiled, and wrought, and fought with me;
That ever with a frolic welcome took
The thunder and the sunshine, and opposed
Free hearts, free foreheads—
Push off, and, having all formed line,
Strike deep with oar and paddle; for my purpose holds
To trace the river to the sea throughout its course.
It may be we shall meet with savage tribes
And the pitiless manikins, of whom we have heard;
It may be we shall grieve and pine with want,
Or be swept over Falls, as others have been.

Though much is taken, much abides; and though
We are not now that strength which in old days
Drove through hostile Turu, that which we are, we are;
One equal temper of long tried hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, and not to yield."

Going down an unknown river! how like a dream it appears! those long, thick, night-black forests rising on each side! which of us can tell what may be there, as waves of foliage rise one above the other to infinity? What were we going to do? Ah, were you to ask me what were my motives in going down this river, to oppose ourselves, as it were, to this impenetrable mystery that terrified the Arabs, and terrified those superstitious natives, I would tell you, I wished to cleave a path of light across this continent; I wished to draw the Gospel, and the missionary of civilisation after me. I said to myself, "How can I do any good for Africa? How can I second Livingstone, who spent the last years of his life in attempting to clear the mystery of this river? I must go down the river. I must commit myself to the flood, and let the flood take me where it will."

We came to the equatorial falls: I tried to go to the right bank. No; there were natives there, and arrows came thick and fast. I tried to go to the left bank. No; there were people ready there. Down the river the cataract was roaring. Shall I go back again? We have already been attacked several times on the river, and we cannot back our canoes against that strong flood, day and night; we could not use the rifle and the paddle at the same time. So we float down to our destiny. We managed to land, however, and then began some terrific work. We must cut a path through the forest by night and lay the branches down on the ground, and, with the early dawn, we must buckle to the canoes and run them along 500 yards to a new camp we have formed; and then wait in the camp till night comes again, for in the night the cannibals will not come, and then out with hatchets and axes and knives, and cut down the trees again, and at early dawn run away another 500 yards to another camp. So it continues from cataract to cataract, from fall to fall, from forest to forest, for 26 days, until at last, when we come to find what we have done, we have cut a road 13 miles long in the forest, and drawn our canoes 13 miles overland and passed six falls.

And now a new mode of warfare comes. The river, which has been measuring its strength against the everlasting hills, expands into a mighty stream, from two to ten miles wide, with islands innumerable near either bank. Village after village is seen, and in them the war-drum sounds day and night, while we are squatting

on the islands among the reeds and morasses. We see dark forms gliding along through the opening glades of the forest. We sail by, just as amiable as we can be. We never say a word, but at every opportunity an arrow comes: there is poison on its tip. If we go to the banks, there is the treacherous savage stealing behind every tree, and at night a spear is sent into the middle of our group. That is our reception. And so the war-drums sound day and night, until at last we come to the confluence of the Aruwimi with the Lualaba. We had been prepared for many things, but we had never expected to see such a sight as we saw coming down this river: 63 canoes coming down in superb fashion, one of them cleaving the water with a speed that 80 paddles gave it, and all the savages arrayed in magnificent war-costume; with feathers of the eagle, the kite, and the bustard waving on their heads; with ornaments of brass and copper and ivory bracelets, and ivory balls on the tops of their paddles, and the great war-drums booming out loud as they came to meet us. As I cast a look at my people, I see that they think the end has come.

I daresay a great many of you people living in England, sitting in comfortable easy chairs within rural mansions, drinking fine wines and champagne, and enjoying the thousand luxuries of civilisation, when you come to be on your death-beds you will think of saying prayers, and all that; but I assure you no man thinks of saying his prayers in the heat of action. Very few men think that they have time for that. Eyes must be all alive, every muscle and nerve quivers with excitement. Is it to be, or is it not to be? Has the time really come to die, and be we know not what? "Drop anchor; be men; remember your wives and children; put the slugs in your muskets, and be prepared; clench your teeth, and be in earnest." "Inshallah, master." "And you, women, lie down in those canoes; and you men who have not got guns, lie down, and do not show yourselves. Let those men that have guns stand, and mind how you receive the first fire. Let them show what they have come for. If they throw a spear, before that spear has lighted, fire! Answer them, and let it be so rapid that they will not have the slightest chance of resisting you. That is the only way in which I can save you. You understand?" "Inshallah, master." And so this great monster comes down, and the war-drums sound, and war-cries are shouted. What a world it was! what a frantic cannibalistic world it was! What bit of grace could we hope for? Well, this monster came, the leader of 62 others. It was a beautiful sight! I should have admired them if they had allowed me to admire them. I could really have said that they were splendid fellows, could I have

been seated in those chairs at home, looking at them. I could really have indulged almost in sentiment, had I a wife by my side and I could say, "You see, my dear, what a fine set of people they are." But we have not time for this. They won't allow us to do it. The shields are up, the spears are launched; the Rubicon has been passed; there is no more cry for peace. We won't ask for quarter, for no quarter will be shown. Well, 52 muskets ringing in a land where never before musket echoed is astonishing, extraordinary. You may talk about a thousand torpedoes in the middle of London blowing up, it would not create so much excitement as those 52 muskets in a part of Africa which never heard a musket before. "What extraordinary medicine is this!" In five minutes it is all over; but some of our people have been punished. Unfortunately you cannot save every man, but you can do your best. At last I say, "This is an awfully savage country; which is the best, to die quickly and sharply by the spear, or to die of hunger? What do you say?" "Well, master," said they, "it is very hard to die, anyhow." "I quite agree with you; but you see there are some very soft-hearted people—those people who sent me here—and they have charged me that I must avoid fighting. Now my object is to get along as peaceably as possible, but you see I cannot." Talk about Geography or humanity! They would not allow that I should trace the banks and listen to the names, so I must search my way among the islands; and so for five days I crept in and out among the islands, watching sharply for the channels; sometimes getting near the natives, for you cannot help it, because the channels occasionally sweep you in full view of the river, and at once the war-drums sound and the natives come up, charging with their canoe, and the spears and arrows fly again. Ah! there is blood and thunder once more! but still we do the best we can, and get along as quietly as possible. And could we only sleep the long, long weary time, and wake once more and find old ocean, how happy should we be! But it is of no use; we wind among the islands and suffer hunger. Did we go to the mainland, we were attacked; and so, day after day, day after day, we drifted down, amid such terrific vicissitudes, experiencing hunger and war, war and hunger.

At last we came to the cataracts; and here began work of a different nature altogether. We have Nature herself asserting her divine right to be alone, except that we are also children of nature, and that we must penetrate her mysteries, and assert our relationship. We must also cling to the river to the very end, lest when I come back to England or America, people should say, "Ah, yes, you came to the cataracts, you say; but how do you

know but what there may be a very large distance on which you might sail boats or put steamers, and so introduce trade?" In order that that may not be said, we must follow it. 'And so cataract after cataract, cataract after cataract, rapid after rapid, we pass. Fortunately the natives here are kind; they are amiable. As I told you before, if a native will only allow you to speak to him, it is nine chances out of ten that you will make a friend of him; but if he won't allow you to speak to him, if he comes at you with a drawn bow and lets fly, why there is no time to be friends then; and so I found in Unyoro. Five months of battle with these cataracts, until we came to the last. We had arrived at Tuckey's furthest, the Cataract of Isangula, which is 45 geographical miles from Boma, where the steamers stop. For the last week or so we had been suffering dreadfully from hunger; scurvy had broken out; several of our best people had been lost; I myself had been nearly lost three times; and now we could say that we had followed the river from Nyangwe, Livingstone's furthest, to Tuckey's furthest, and had connected the great river called the Congo with that great river called by Livingstone the Lualaba.

From Tuckey's furthest to Boma was just a fight against famine. Three days' journey from Boma I sent four men to Boma to get supplies, though our people did not believe that they were near the sea. They did not believe that there were any white men there. Had they not been fighting ever so long against all sorts of natives? "And here the master says we are close to the sea. He only wants to make us glad; but we will never, never, never see it again." Four smart young fellows, who, from sheer emptiness, had buckled their belts as tight as could be, started off; and the indomitable coxswain of the *Lady Alice* said, "If all the rest die by the side of me, I will to-night reach your white brothers, and tell them the story—tell them that, if we do not get food immediately, we are dead men. Master, let me alone for telling them how we are." As I looked at that narrow waist of his, buckled as tight as it could be, so that he might not feel the pangs of hunger, I almost fancied I saw the last of that brave fellow. But I had great faith in him. He had done great deeds in Africa for me. He had saved fifteen men at the cataracts; he had done his best, gone down in the whirlpool, to save poor Frank Pocock; and when you see such a man, be he white or black, I assure you that you must like him. Well, I will leave the merchants of Boma to tell the story. One of them said, "Mr. Stanley, it was about 9 o'clock at night when a wild fellow, with a miserable rag round his loins, came to me, and bent down to the ground, and handed me a letter. I did not know

what to make of this man. I looked at him, and then I took the letter in my hand: 'To any Englishman in Boma.' The native did not know what to say, because he was from the other ocean." So, with a superstitious dread, this white man, who can talk English, looks at the letter. "Where is it from? It is only 'To any Englishman in Boma.'" He is the only representative of an English firm in Boma, and he opens the letter: "Dear Sir,—I have arrived with 115 souls here, in a fearful condition . . ."

"Look, this is Stanley! Stanley come back, come from Zanzibar!" Then he sends word to the other merchants in Boma; he tells them "Stanley is close here: he wants food;" and all the merchants gather round and say, "No, you are chaffing us; it cannot be." "There is the letter, read it." They did so, and they all said, "We must not delay;" and so they look at these men, "If there is one man here who can talk English, which is he?" "I can, Sir," said a pupil of the Universities Mission, trained at Zanzibar. "So you can talk English; is it true that Stanley is here?" "It is quite true, sir." "And is it true that you are suffering from hunger!" "Aye, so much—the people are dying for want of something to eat." He at once called all his people, and charged them with baskets of bread and fish, and rum and tobacco, and said, "Hurry, hurry! hurry!" And so the next day the coxswain, with his belt not buckled quite so tight, hurries up, and leads the supplies, just as proud as though he owned all the goods that he was bearing for us.

I suppose it was the proudest moment in the world when Uledi came to us in triumph. The little boys of the camp had been lying down on the ground listlessly, languid, given up to total despair and desolation. Suddenly one of them sprung up: "Master, master, Uledi is coming; we shall have so much food now to eat! Master has found his white brothers." Such cries as these from the little boy rouse up the entire crowd. What! why! it is the relief of Lucknow over again. Then, of course, the fish and the biscuits, and the cloth and the rum are set before us. We must distribute them just as fast as we can. We do not deal out rations now. We say, "Take, take, take;" and they all scramble for the food, and they do not stop to cook the rice; they just swallow it. And such oceans of rum they took! but then, you know, sailors and soldiers are said to be rather fond of rum; and if there were ever any people entitled to call themselves veterans, these people, who had crossed Africa, deserved to be; and if rum is the pay of the veteran, certainly they must be forgiven if they got intoxicated for once. Of course, being a temperance man myself, I would not allow it frequently, but

only for this day. What remains but to replenish ourselves, and the next day start away towards Boma? When we were a few miles from Boma, out came the hammocks, and I am told by one of my gun-bearers, "Master, you see the white men are coming, —yes, white men; see, they are coming in hammocks." We are only 4 or 5 miles from Boma. Such a number of magnificently dressed white men! What immaculate waistcoats they had! what splendid gold chains they had! how neatly their hair is brushed, their moustachios all neatly curled! Immediately one of them comes forward and says, "I have great pleasure, sir, in seeing you." And I say, "This is civilisation once more?" Yes, and now it comes to dressing for dinner, to bowing upon every occasion; now it comes to be strangled with collars; and now you must be polite, and now you must be charitable. Well, so long as I get decent food and decent sleep, and there is no great strain on my mind, no great strain on my strength, so long as I am not a mere skeleton, why, I will challenge any of you to be more charitable than I shall be. Then we came in sight of the steam canoe, and those who had never seen a steamer before, tried to find where the paddles were going to be. "Who is going to paddle her down to the sea?" asked those men who had followed the river, some of them all the way from its very source. "Master, must we paddle this great big steamer to the sea?" "Oh, no; fire will do it; you have arrived in a land now where fire does everything." "Ah, yes; could the white man only reanimate the dead." "I brought you down the Congo to Boma; I have brought you face to face with that Atlantic Ocean, and what are we to do now? Why, now it is simply to eat and to drink, and to care not for the morrow; to think of nothing but rest, absolute rest, though it lead to eternity." We come to Loanda; we are nourished by the Governor, we are favoured by the citizens and the Geographical Society of Loanda. Geographical Societies follow me everywhere, gives me such a welcome; and in their grand hall—the theatre of Loanda—I see the names of dead and living explorers on shields, with lamps behind them; and when I respond to the toast that they give, I cannot help taking a lesson from the names of the dead, so many of which I see around me. Such and such a man was lost in such and such a place; Vonderdecken lost in the Jub; Roscher, on the shores of Nyassa; Tuckey, a martyr to his love of Geography; Mungo Park, on the Niger; culminating in the death of that great martyr Livingstone on the shores of Lake Bemba.

And so the time has come when Her Majesty's ship, lent to me by

Captain Purvis, must lift anchor and part from Loanda. In due time we arrive at the Cape of Good Hope, and are well treated by the English there. Lady Frere astonishes the people by her kindness. The people of Cape Town show them extraordinary generosity, let them have the "fire-carriage" for a day; and when I ask them what they think of the fire-carriage, they say, "Ah, master, why do not you take this for a pagazzi to go across the continent? It would be so much better." I said, "The day will come, and you, my people, have done your best to bring it about; and, mark my words, the result will be that some time or other that fire-pagazzi will be employed to cross the continent."

A month afterwards we were at Zanzibar, and the people who had left that little island in the Indian Ocean were all in a perfect fever. "Is it possible? Shall we see our island once more?" They see every well-known point; every palm-tree is known to them. How many traditions, how many stories, how many incidents are connected with each palm-tree and height, with each prominent point that they see! And the naval officers notice it, and say, "Just look how your people are laughing; now just watch, and see how they behave when they reach the island." But do they not know that my people are in a hurry to go and embrace their mothers; to go and embrace their children; to go and kneel before their fathers and ask them for the blessing? Do they not know that? We watch them with glasses, eager and anxious to see how they behave. The people on the island do not know who these people in white clothes are who are jumping so frantically about, or why they should come from the man-of-war. Are they captive slaves? Oh, no; people dressed in such nice clothes cannot be captive slaves. What kind of people can they be? So the inhabitants of Zanzibar bound along the beach to watch until that first boat shall arrive? "Who are you?" "We are people who have crossed the continent, and have come back." "How many years ago?" "Oh, long, long time; how long we cannot tell you, but months and months ago. Why, look: this boy when we left Zanzibar was only so high: look at him now, so tall, strong, and stalwart." They would not wait until the keel of the boat touched the beach, they jumped out, and, would you believe it, the minute they landed upon the beach, they fell down and kissed the sands of their island. "El Hamd'ul illah!" ("Thanks be to God!"). What better sentence could I use this evening than repeat what they said that day—that great day for them, when, after so many experiences, they return to their island and kneel down with hearts suffused with gratitude? What more can I say now

than repeat what they said, "El Hamd'ul illah!" "Thanks be to God!"

Ladies and Gentlemen: I have occupied your time much longer than I anticipated I should occupy it. But it was your patience, your politeness, such courtesy as I never saw in Africa, except at King M'tesa's, that won me to go on; and now that I have occupied your time so much, I wonder whether I have offended you. If I have, will you forgive me? All I have got to do is to thank you for your very hearty welcome, and to promise you that, if ever I go to Africa again, I shall describe with much more graphic powers than I have employed to-night what a welcome I have received in England.

On the conclusion of the Lecture, H.R.H. The PRINCE OF WALES rose and said:—

Mr. President and Gentlemen: after the most interesting, exhaustive, and entertaining account which the distinguished traveller and explorer who has just sat down has given us, it is impossible for me not to express in my own name my thanks for what I have heard to-night; and perhaps I may be allowed, as the spokesman on this occasion of the large assembly which surrounds us here to-night, also to express our cordial and sincere thanks for the interesting evening which we have spent under the auspices of the Royal Geographical Society. There is nothing for me to add, after the interesting account we have heard, and I think it will be evident to all those who are here present, how wonderful has been the endurance, and how severe the privation which Mr. Stanley has undergone for the sake of Science and Geography. We congratulate him upon his return after all he has gone through, and we sincerely hope that, if it should be his intention once more to undertake other difficult and arduous journeys, such as the one he has so happily accomplished, I, for one—and I am sure you will all second me—wish him as great success in his future journey as the one he has just now accomplished.

Sir SAMUEL BAKER said he was sure every one present would agree with him that the work Mr. Stanley had accomplished proved him to be too great a man to enjoy any exaggerated amount of adulation that might be bestowed upon him. He would therefore refrain from unnecessary compliment, but he might perhaps be excused for drawing their attention to the state in which Africa was when the Royal Geographical Society was first instituted. It was an extraordinary privilege to have been born within this last half century, to have been able to watch the increase of science, the immense strides that had been made in almost every invention, and to trace the wonderful development not only of engineering skill, which has brought distant nations comparatively near, but of countries that were previously unknown.

A very short time ago the centre of Africa was as unknown to Europeans as it had been to the ancients. There had been in that mysterious land some great bar to travellers, some great barrier to civilisation, and apparently no one had been able to penetrate it; but, with the advance of science and of chemical knowledge, a drug had been discovered which had done more to open up the continent of Africa than the heroic character of past ages. He felt perfectly convinced that their efforts in the exploration of Africa would not have succeeded as they had done if it had not been for the discovery of that simple drug, the sulphate of quinine. But Africa was still a mysterious continent. Although Speke, Livingstone, Stanley, and others had opened up paths which were previously unknown, mystery still clouded the country. Although Englishmen—and of course he included Americans—prided themselves on the fact that they had effected more than all other nations, still the history of the country remained a blank. New tribes had been discovered, which were in existence when the Pentateuch was being written, when the creation of man was being described by Moses; but nothing was known of their past history, for there was not a chiselled stone to be found throughout the whole of Africa. At the same time in almost every portion of the continent domestic fowls were to be found, and domestic sheep and oxen, while there was no such animal as a wild ox or wild sheep. The question then arose, Whence came the progenitors of those animals which were now domesticated? That was one of the most extraordinary mysteries of Africa, as nothing was known of the inhabitants ever having had intercourse with other portions of the globe. Vegetables were also found there which were formerly supposed to be confined to America only. He thought that Mr. Stanley and Colonel Grant would bear him out in saying that tobacco was found in most parts cultivated, but never indigenous. Indian corn also, which was formerly supposed only to have come from America, was found growing in most parts, but never indigenous, and the same might be said of the castor-oil plant. Cotton was indigenous in many parts, as was described by Pliny. These mysteries must be intensely interesting to those who took pleasure in the development of new lands. All savage countries that were to have a future must necessarily possess means of communication, and some natural productions which would lead to commerce and to industrial pursuits. Without this the efforts of the missionary could not be very successful. The Meeting had listened to Mr. Stanley with extreme attention; and although they had rewarded him with their plaudits, none could thoroughly appreciate his enormous labours except those African explorers who had laboured in a similar field. He was sure that Mr. Stanley, as an American, would look back to this evening, and regard the welcome given to him not as a mere formality, but as coming from their hearts, and would feel that the kind words of encouragement and thanks which His Royal Highness had so graciously offered him expressed the voice and the gratitude of England.

PROCEEDINGS
OF
THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED MAY 9TH, 1878.]

SESSION 1877-8.

Seventh Meeting, 25th February, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Thomas W. Goad, Esq.*

ELECTIONS.—COUNCIL MEETING, 11th FEBRUARY.—*Aug. Adderley, Esq. ; Sam. Barrow, Esq., Junr. ; F. B. Fynney, Esq. ; Cecil Guinness, Esq. ; Eli Lees, Esq. ; Duncan Macneill, Esq. ; William Henry Maturin, Esq. C.B. ; Anthony Trollope, Esq. ; Sir J. W. Walrond, Bart. ; William Henry Willans, Esq. ; Charles E. Willis, Esq.* FEBRUARY 25th.—*James Brand, Esq. ; Capt. T. C. R. Colomb, R.M.A. ; Percy Cooper, Esq. ; Lieut.-Col. John Jago (Major 74th Highlanders) ; Vice-Admiral Geo. G. Randolph, C.B. ; Walter Turnbull, Esq. ; Rev. J. Eduard White.*

DONATIONS TO LIBRARY, 28TH JANUARY—25TH FEBRUARY, 1878. Sun pictures of Rocky Mountain Scenery, by F. V. Hayden, New York, 1870, and Bulletin of the U. S. Geological and Geographical Survey, IV., No. 1 (*Dr. Hayden*). Pioneering in South Brazil, by T. P. Bigg-Wither (*Author*). Cleopatra's Needle, by Erasmus Wilson (*Author*). Seeking the Golden Fleece, a Record of pioneer life in California, by J. D. B. Stillman, San Francisco, 1877 (*Author*). Remunerative Railways for new countries, with some account of the first Railway in China, by R. C. Rapier (*Author, per Sir Rutherford Alcock*). El Monitor Rebelde Huascar, por J. A.

Garcia i Garcia, Lima, 1877 (*Author*). Collections scientifiques de l'Institut des langues orientales du Ministère des affaires étrangères, I. (Manuscripts Arabes, par V. Rosen), ii. (Monnaies des Khalifes orientaux, par Dorn), St. Pétersbourg, 1877 (*The Institute*). Conferences held in connection with the special loan Collection of Scientific apparatus, 1876. Chemistry, &c., and Physics (*The Science and Art Department, South Kensington Museum*). Palestine Exploration Fund, Quarterly Statement, No. 4 of 1869, and various preliminary Reports, including i.—xxv. (*W. Besant, Esq., Sec. of Fund, towards completion of Series: N.B., the No. for January, 1872, is now the only one wanting*). Results of observations, 1875, xxxv. Radcliffe Observatory (*The Trustees*). Quarterly Weather Report of Meteorological Office, 1875, parts 1 & 2 (*The Meteorological Council*). Procès-verbal de la 17^{me} Séance de la Commission Géodésique Suisse, 1877 (*Dr. Ziegler*). Statistics of New Zealand for 1876 (*The New Zealand Government*). Report of Mining Surveyors, &c., 30th September, 1877, and Australian Statistics for 1876 (*The Government of Victoria*). Cassell's Natural History, vol. i. (*The Publishers*). And the current issue of publications of corresponding Societies, Periodicals, &c.

DONATIONS TO THE MAP-ROOM, FROM JANUARY THE 28TH TO FEBRUARY 25th, 1878.—Government Surveys of India, 72 sheets (*H. M. Secretary of State for India, through the India Office*). Admiralty Charts, 8 sheets (*The Hydrographer*). Ordnance Survey Maps, 638 sheets, and Area Books (*The Director-General of the Ordnance Survey*). Topographischer Atlas der Schweiz im Mafsstab der Original Aufnahmen, parts 10 and 12, containing 24 Maps (*Chief of the Federal Survey*). Sketch Maps of Wassaw, from the Latitude of Axim to that of Awuduah, MS. (*J. A. Skertchly, Esq.*). Sketch Map showing the route of Mr. Baillie, Government Surveyor, from Barkly, Griqualand West, to Gubuluwayo, Amandebele, MS. (*H. E. Sir Bartle Frere, Governor of the Colony of the Cape of Good Hope*).

The PRESIDENT said he had the pleasure of introducing Mr. Bryce, whose name was well known as a traveller. Mr. Bryce would give a lecture upon some of his explorations in Armenia, especially his ascent of Mount Ararat. He was afraid that Mr. Bryce had not brought back any authentic relic of the Ark, but he had certainly ascended the highest peak of that great range of mountains. He had also travelled a great deal in Armenia, and he would give many interesting features not only of the physical geography of the region but of the state of civilisation of the people and their mode of life.

On Armenia and Mount Ararat. By JAMES BRYCE, D.C.L.

After some prefatory remarks, Mr. BRYCE proceeded as follows :

ARMENIA, as some one said twenty years ago about Italy, is not a country, it is a "geographical expression." There is, properly speaking, no such country as Armenia, that is to say, there is no country called Armenia, which has any definite natural boundaries or any distinct political limits, or in which any single race conspicuously prevails. Armenia is perfectly undefined, and it would be impossible to lay down either a natural limit, or a political limit, or an ethnological limit, in which geographers could acquiesce. Speaking generally, you may say that it consists of the upper valleys of three great rivers,—the Araxes, which rises not very far from Erzeroum, and flows ultimately into the Caspian Sea; the Euphrates, one branch of which makes an immense sweep, first to the west and then to the south-east, until it falls into the Persian Gulf; and the Tigris, whose course is generally parallel to the Euphrates, only further east. Taking Armenia in this general sense, it occupies a lofty region, which lies round the sources and upper courses of these great streams, and also includes three remarkable lake-basins. One of these, that of the Goktcha Lake, discharges itself into the Araxes by the River Zenga. The two larger lakes of Van and Urumiah are close basins, that is, receive streams, but discharge none, their surface being reduced by evaporation. Armenia is something like 250 or 300 miles each way, and through the whole territory there prevail certain physical characteristics which enable one to describe it in common; although there are, of course, abundant differences of detail in different parts.

It is an extremely high country, no part of it being less than 2200 feet above the level of the sea; the lowest part being the valley of the Araxes. Some of the plateaux, like that round Erzeroum, lie as much as 5000 or 6000 feet above the sea-level. It is in most parts very mountainous. There are here and there considerable plains, like the plain of the upper course of the Araxes, where you have 40 or 50 miles of comparatively level ground; but in the main it is extremely rugged, and intersected in all directions by ranges of lofty, barren, dry mountains, which combine the maximum of height and the minimum of picturesqueness. I do not suppose it would be possible to find anywhere hills which, for their height, make so little impression upon the beholder, the reason being that they rise from these lofty plateaux, and therefore

do not show their full height to the beholder's eye. The country being elevated, and far removed from the influences of the Western Ocean, the climate is, as you will easily understand, extremely dry ; the rainfall in some parts not exceeding four or five inches in the year. The climate also is very cold. It is hot, indeed, during the short summer, which lasts from the middle of May to the end of October ; but intensely cold in winter, keen dry winds coming down from the frozen wastes which lie to the north-east and east beyond the Caspian. In the higher parts, the winter lasts full six months in the year, and is a great deal more severe than in any part of Western Europe. The climate being cold and dry, one is not surprised to find an extraordinary bareness in the landscape. Few parts of the world, not absolutely deserts, have less wood on them, and this, of course, has an unfortunate effect on the scenery. In north-eastern Armenia, of which alone I can speak from personal observation, the only wood which one can find, except along the courses of the streams, where you have plenty of bushes and small trees, is composed of a sort of oak-scrub, which clothes the slopes of some of the mountains, especially in more sheltered glens ; but large trees, such as one might find in an English park, are all but unknown ; and, of course, this want of vegetation still further increases the natural dryness of the climate. For the same reason, the fertility of the country is not turned to the best advantage. The soil is productive, and the summer is hot enough and long enough to enable all the crops of temperate climes to ripen, but the want of water is so great that it is, generally speaking, only where artificial irrigation can be employed that good crops can be raised. Except upon the higher slopes of the mountains, where a greater amount of rain falls, no harvests of any considerable weight or value are obtained, unless by means of artificial irrigation, where some stream descends from the mountains, which is led in small channels by the industrious peasantry through their fields. Many of the ancient irrigation works, which seem to have been constructed at very remote periods, have been allowed, in the political misfortunes of the country, to fall into decay, so that probably one sees the country now in a lower state of prosperity and fertility than it was 1500 or 1300 years ago, in the times when it belonged alternately to the Roman and Persian empires. Nor is it easy to see how it can be made anything more of until it has fallen into the hands of more enterprising and wealthy governments than those who now possess it.

I ought perhaps to tell you that Armenia is divided between

three empires. The greater part of it, including the whole southern and western part, belongs to Turkey. The south-eastern corner, towards the great lake of Urumiah, belongs to Persia. And it is a sort of race between Persia and Turkey which shall govern the worst, and which shall do the least for the countries under their control. Anything more wretched than the condition of Persian and Turkish Armenia cannot be imagined. Although Russian Armenia, that is, the northern and north-eastern part of the country, is no doubt far better off, though life and property are secure, and one or two roads have been made, still the Russians are too poor and too much occupied with other enterprises to have done half of what is wanted to develop the material resources of the country; so that the country, if it cannot be said to be actually going back, is hardly going forward. It wants a great deal more capital and more opening up before it can be a profitable investment for the Russian Emperors; and that consideration is perhaps not without its weight when we come to consider what the results of a Russian annexation of the larger part of Armenia would be. I venture to believe—and I think I am expressing the opinions of most of those who have travelled in these countries—that any further large annexation of territory in that direction (whether the Russians will insist on it or not, I do not presume to prophesy) will be merely a loss and a burden.

The people who inhabit Armenia are very various. There are two great indigenous races, and there are a considerable number of immigrant tribes, who at one time or another have poured into the country from the border lands to the east and north. The indigenous people are the Kurds and the Armenians. The Armenians themselves, who, so far as we know, have been there since the beginning of things, number about two or two and a half millions. There are really no data for arriving at a just estimate of their numbers. The total number of Armenians in the world is estimated at between four and five millions, and I fancy that fully one half of these may be held to reside in Armenia proper. They are a people who have had a great past, and who, I think, may have possibly a great future. In Armenia itself they are a quiet, submissive, stay-at-home people; peaceable in their habits, mostly devoted to agriculture, living on their own farms, cultivating them in a steady-going way, showing little political interest and no ambition, apparently indeed without any political aspirations except those which connect themselves with their religion, because they are profoundly attached to their own form of Christianity, which they have cherished ever since their conversion in the time of

Constantine, and still more intensely after they were cut off from the general body of the Eastern Church, by rejecting the decrees of the Council of Chalcedon. Physically, the Armenians are rather short of stature, and inclined to be stout, somewhat swarthy, with black hair, and usually large noses. They are extremely enterprising, and have a talent for money-getting, surpassing that of perhaps any other race in the East. Considering the intellectual power which they sometimes display, even if they chiefly display it in that direction, one cannot help thinking that if the influences of Western civilisation are brought to bear upon them in their original seats, they may develop into something much greater than their recent history has shown.

The other race, the Kurds, are in most respects a great contrast to the Armenians. They have been there also from the beginning of history, and have lived intermixed with the Armenians, although when we first hear of them (which is in the 'Anabasis' of Xenophon) they are mentioned in a district more to the south than that of which I now speak. Xenophon seems to have met them on the Upper Tigris, not far to the north of the city of Nineveh, and they still inhabit that district. They also roam over the whole country to the north as far up as the slopes of the great mountain called Alagoz, which lies about forty miles to the north of Ararat. That is the northern limit of the wanderings of the Kurds; on the south-west they may be found as far as Baalbec and the outskirts of Damascus. They are a very peculiar race, and in some ways very interesting. In figure, they are stalwart and well made, rather inclined to be short than tall, but with extremely sinewy forms. Their hair is black, but not so straight as that of the Armenians. Their eyes are small and fierce. They are excellent horsemen, and they never have their weapons out of their hands. All are nomads, who have no regular houses, much less towns and cities, but wander about the mountains with their flocks and herds; living in tents made of goats'-hair. In summer they seek the upper parts of the mountains, and in winter they come down, driving their cattle into the valleys of the great rivers, and to a large extent quartering themselves upon the Armenian peasantry, whom they rob and murder to their hearts' content. A more mischievous set of people than the Kurds cannot be imagined. They have not even the merit of being fanatical Mahommedans. Their religion is merely a cloak for robbery. It is a proverb in the Mahommedan countries, that no saint ever came out of Kurdistan. They have a bad name, not only for crimes of violence, but also for treachery and falsehood. At the

same time, it is impossible not to feel some degree of interest in them, because they show a certain amount of valour and enterprise. They have shown in one way an intense sentiment of nationality. They have never submitted to any one of the empires which have held sway in those countries. They were independent of Persia in the time of Xenophon, and they do not seem to have done more than admit in a sort of loose and general way the suzerainty of the different potentates who have from time to time overrun these regions. And at present, although they live in what we call the dominions of Turkey, they practically owe no allegiance to the Sultan, but are governed entirely by their own chiefs. As you have no doubt seen from the newspapers, they enlisted in large numbers in the Turkish armies in this war, but, as any one who knew their habits might have predicted, they proved of no value to the Turkish commanders: they employed themselves merely in rapine. When they received an order they refused to obey it, and they have probably done more to discredit the Turkish Government, by the excesses which they committed upon the Armenian peasantry, than could be compensated for by any military services they could render.

Besides these two races of Armenians and Kurds—the one of course Christian and the other Mahommedan—there is a considerable population which has from time to time flowed in from the East and North. A certain number of Circassians have come down and settled in North-Western Armenia, in the country round Kars and Ardahan. A considerable number of Tartars have settled in the Araxes valley, and spread a little into the valley of the Euphrates. A small population of Ottoman Turks has mingled with the Kurds and Armenians in the Turkish part of Armenia. And of course there is the Persian population in the towns, the Persians having a good deal of the trade of the country in their hands. All these races are Mahommedan. It is impossible to ascertain the exact proportion of Christians and Mahommedans, but I fancy that the Christian element is on the whole in the minority. In the Russian territory perhaps that is not so. I suppose that in the valley of the Araxes, taking the Russians themselves, who are only officials, and a few German colonists and the native Armenians, the Christian population may be larger; and in the neighbourhood of Van this is also the case; but over the whole of Armenia, giving the name its widest sense, I fancy the Mahommedan population exceeds the Christian.

In the midst of this country, very nearly in the centre of it, rises the great mountain which is to many of us the central interest

of Armenia, I mean Ararat. Every one must be interested in a mountain which figures so largely in the early history of our race. Ararat, however, cannot be specifically identified with any particular mountain mentioned in the Bible. You remember that the phrase in the Bible is: "the Ark rested in the tenth month on the mountains of Ararat." Now Ararat is used in the Bible there, and also in one or two other places, as a name for Armenia; or, at least, for the part of Armenia in which our mountain lies, that is the northern part. Therefore the Biblical passage only goes to this, that the Ark rested upon a mountain in the district which the Hebrews knew as Ararat, or Armenia. At the same time our mountain is so very much higher, more conspicuous, and more majestic than any other summit in Armenia, that one could hardly doubt that if the Biblical writer had any particular mountain present to his mind, it must have been our Mount Ararat. No one who had ever seen it could have any doubt that if the Ark rested anywhere in that part of the world, it rested upon that particular summit. It is so much higher, so much more isolated, so much more imposing than any other, that it is just the place where an ark ought to rest. And whatever the local legends may be worth, there can be no doubt that there are legends, going back for hundreds or thousands of years, which assign this particular mountain as the scene of the Flood, although the native names for the peak are *Massis* (Armenian) and *Aghri Dagh* (Turkish). I fancy that these legends began about the second or the third century of the Christian era. My attention was turned not long ago to a passage in a writer named *Africanus*, who lived in the time of the Emperor *Heliogabalus*, who speaks of his having visited Ararat, and of its being mentioned as the place where the Ark had rested. He says it was in *Parthia*, which is rather a vague name. At the same time I ought not to conceal from you that there is another legend, which is still adhered to by the Assyrian Church, and seems to have prevailed among the Jews in the time of *Josephus*, which places the Ararat of the Bible very much further to the south, among the lofty mountains which overhang the valley of the *Tigris* and the *Zab*. That legend appears also to be received in the *Koran*, where the Ark is said to have rested upon a mountain called *Gudi*. I speak under the correction of Arabic scholars, but I believe that is the name given in the *Koran*, and I think that the *Gudi* of the *Koran* is commonly identified by Arabic geographers with the mountains lying in southern Kurdistan, upon the borders of what we now call Assyria.

The mass of Ararat is fully 25 miles long from north-west to

south-east, and something like 12 or 14 miles wide. The total circumference may be about 80 miles, and it consists of two distinct peaks, which are united to one another by a sort of saddle, or col, and which beautifully contrast with one another, each seeming, by its proportions and form, to enhance the effect of the other. Great Ararat, which is the north-eastern of the two, rises 17,000 feet above the sea, and 14,500 feet above the level of the Araxes, which flows at its eastern base. Little Ararat is about 12,800 feet above the sea. The two are separated by a depression, a sort of little alpine plain, whose average height is from 7000 to 8000 feet, and over this depression there runs a track, which leads from Aralykh, in the valley of the Araxes, to the Turkish town and fortress of Bayazid. Great Ararat is an enormous dome rather than a cone, a prodigious mass somewhat irregular in shape, broadened out a good deal in the sides, but at last coming to two comparatively small peaks. Little Ararat, on the other hand, is an extremely fine and delicate pyramid, showing from some quarters as a cone, but, on the whole, best described as a four-sided pyramid, which rises up nearly to an acute point. It is as elegant a mountain, I suppose, as one could find in the world; and huge as it is by itself, because its height is 12,800 feet, so that, as I need hardly remind you, it would make a very great figure in the Alps, it looks like a mere buttress when placed by the side of its gigantic brother. And the effect of the two often reminded me of that which is produced when from Westminster Bridge one sees St. Margaret's Church against the Abbey. Just as St. Margaret's Church, which seen elsewhere would be a respectable building, looks small by the side of that gigantic pile behind it, so Little Ararat serves to give a loftier conception of the majestic mass which rises to its north-east.

Both mountains are of volcanic origin. That is a thing that no one will doubt who looks at their shape, even if he does not examine the materials of which they consist. They have been frequently examined by competent geologists, and all the rocks that are found there have clearly been produced by volcanic action. Neither peak, however, has quite the sort of summit which we should have expected. The common idea of a volcanic peak is of a tapering cone, a sort of sugar-loaf with a crater at the top. Now the top of Little Ararat, which is quite small, is nearly level, with three or four huge blocks or crags rising out of it, but nothing like a crater; and Great Ararat, whose top is rather larger, has a curious little valley lying between two big hummocks of ice, which constitute its summit, but there is nothing

like a crater at all, and it is left to our imagination to fancy whether or no there once was a crater whose edges have been worn away by the influence of the atmosphere in the many centuries, perhaps thousands or millions of years, which may have elapsed since it was first formed, or whether (as some geologists have supposed) there never was really a crater at the top at all, the mass having been piled up by lateral eruptions, which have thrown out huge jets and flows of lava on each of the sides, while the explosive forces of steam, which were also ejecting the lava, have raised the previously existing rocks into the pinnacle which we now see. Either hypothesis seems to be possible. It may be that there once was a crater, which has been destroyed; or it may be that the present summit is not the result of eruptions through a central vent, but simply of an elevating force acting from below, and upheaving the rocky masses into their present position. At any rate, so much is clear that, whether or not there ever was a crater at the top, there must have been many craters and vents along the sides. One can see in going up, and when one looks down from the summit over the sides, hundreds, I was going to say, of small volcanic vents, some perfect craters, some merely chasms or rents, out of which the lava flowed, and which have, no doubt, been active at different times in the long history of the mountain.

It is not only its volcanic character that makes Ararat singularly unlike any mountain in the Alps with which we are familiar; it is also the peculiarities of the climate. Here, in Europe, a mountainous country is always a wet country; but Armenia is so parched, that Ararat wants almost all the features which we commonly associate with a Western mountain. It has a comparatively scanty vegetation. The climate is so excessively dry, and the rock is so porous, that even the streams that escape from the snows get swallowed up as they descend the mountain, and disappear before they reach the middle; the consequence is that, except when the snows have just melted and the grass springs fresh, the mountain is painfully arid, and one may wander for miles and miles over it without finding so much as a drop of water; so that you may readily suppose that no effort of imagination can be greater than that which is required to imagine such a mountain dripping and steaming after it has recovered from a tremendous flood. I fancy that few mountains of equal magnitude are, and for that reason, less interesting to the botanist or the zoologist, because the absence of wood and the scantiness of grass and rain not only limit the flora very much, but also the animal life. Wild animals would, of course, harbour much more in a mountain where there

were deep glens and thick woods; and the woods on the side of Ararat are so small and so low that they afford little shelter either to birds or beasts. Nor is the mountain much better provided with human inhabitants. There are a few Kurds, who wander with their flocks and herds over it; but there is no permanent settlement, no village anywhere upon the skirts, except on the north-eastern face, in the direction of Aralykh, where stands a hamlet inhabited by a few Tartars, who cultivate two or three fields of oats and wheat, and feed their flocks upon pastures that are watered by one of the very few springs in the mountain. This village is Arguri (New Arguri), which is not very far from the site of old Arguri, the place where Armenian traditions placed the vineyard which Noah planted when he descended from the mountain; where they showed, until thirty-eight years ago, the actual vine-trunk which he planted, and out of which came the grapes that he partook of too incautiously; and where there was a willow-tree that had sprung from one of the very planks of the Ark itself. Those sacred relics, unfortunately, are no longer to be seen, because in the year 1840 a terrific earthquake shook down an immense mass of crag on the north-eastern side of the mountain, and overwhelmed the whole village. Every person in Old Arguri perished; the little monastery which stood there was covered up, and all the relics—the vineyard, the willow-tree, the spring of water, and everything else—were buried or destroyed. The present village of Arguri stands a mile or two lower down, and has not the same interest for us as the older one would have if it had survived. But, such as it is, it is the only place upon the mountain which is inhabited at all, and it is inhabited, not by the Armenians who lived in the old village, but by a few miserable Tartars.

Perhaps the best thing I can do, in order to give you some idea of what the mountain is like, will be to describe, in as few words as I can, the ascent which I had the good fortune to make to the summit of Great Ararat in the month of September 1876.

I ought perhaps to say that the mountain was first ascended in the year 1829 by a Dr. Frederick Parrot, a Russo-German Professor in the University of Dorpat, a man of great enthusiasm for science and for mountaineering. He undertook the journey from Dorpat for the sole purpose of ascending Ararat, and making scientific observations upon it. He made three attempts, in the first two of which he was unsuccessful, and in one of which he nearly lost his life; but in the third he succeeded. He carried with him to the top a body of, I think, five companions—three of them Armenians and

two Russian Cossack soldiers. He was naturally very much overjoyed at his success, and he wrote a book about it, a very interesting book—interesting not more from its scientific facts than from the pleasant impression it gives one of the sincere, ardent, pious character of Parrot himself. But what was his mortification to find that when he published the book hardly anybody believed it. Some of the Russian men of science, whether owing to natural incredulity or because they were jealous of his success, obstinately refused to admit that he had ever been to the top at all, and they went so far as to induce the Armenians who accompanied him (with the exception of one man, who seems to have held his peace) to declare that he had not been to the top, and that what he told was a fabrication or a mistake. When he turned to the two Russian soldiers, they, for some reason or other, were too stupid or too forgetful to give the necessary testimony, so they merely said they had made a long walk over the snow, and could not give any distinct confirmation of his details; and the consequence was that poor Parrot got discredit and suspicion, instead of meeting with the glory which properly belonged to him. But every successful ascent, every exploration of the mountain which has been made since his day, has confirmed the veracity of all the details of his story, and I think there can be no more doubt of his ascent of Ararat than there was of Albert Smith's ascent of Mont Blanc. Since that time the mountain has been ascended on several occasions. It was ascended for the second time, I think, by a certain Russian, named Spassky Aftonomoff, still living at Baku, on the coast of the Caspian, and who went up not so much for the sake of mountain adventure as in order to discover whether it was true that from the tops of the highest mountains you could see the stars at noon-day. I do not know whether he satisfied himself, but the story I was told was that he had turned his journey to account by filling a bottle on the top of the mountain with snow, and afterwards giving drops of the water into which the snow dissolved for the baptism of the children of all of his friends. Then the summit was afterwards ascended by Dr. Abich, the distinguished geologist; and in 1856 by a party of Englishmen, who seem to have been wandering about the country after the capture of Kars. For aught we know, it may have been ascended once or twice besides, but there does not seem to be any accurate record of the different ascents in existence. I ought perhaps to say that, in spite of all these ascents, and in spite of one which was made by a Russian General who took a tent to the top and surveyed it elaborately, there is not a soul living within

fifty miles of the mountain who believes that it has ever been ascended at all. It is an article of faith with the Armenian Church that the mountain is inaccessible, and, of course, when such a notion is an article of faith, human evidence is perfectly powerless.

Well, I found myself at Aralykh, near the north base of the mountain, in the month of September, the year before last, and being at the foot of the mountain, like any properly constituted Englishman I considered that the first thing to be done was to get up. But it was not quite so easy as it would have been had one been at the foot of an Alp of similar proportions, because in Switzerland one would have had nothing to do but to send for guides, and the only difficulty would have been the bargaining about how many francs a day. But here, unfortunately, not only were my friend and I completely ignorant of the languages of the country, and unable to communicate with any of the people who were to accompany us, but none of these people had ever been to the top, and they all believed that it was utterly impossible to go to the top. They therefore looked upon our desire to go up as a mere piece of madness, in which they felt a great deal of doubt as to whether they should lend their assistance. Very fortunately, however, the officer with whom we were staying at Aralykh, and to whom we had been recommended by the Russian military authorities in Tiflis, was one of the most agreeable and intelligent persons whom I have ever met, even in the military profession. He was a Mahommedan noble, who came from a district on the north side of the Caucasus, called Kuburda. Curiously enough he was a Colonel in the service of Russia, commanding a detachment of Cossacks, and an extremely strict Mahommedan; so strict that, although he had his table covered with the best wines of those countries, and with English bottled stout and porter, he never tasted any intoxicating fluid, while he constantly plied his guests with them. A man must be a pretty strict Mahommedan to carry his self-restraint so far as that. But his religious faith did not seem to make him a less loyal subject of Russia. At that time the war, although it had not broken out, was being talked of, and we could perceive that he himself thought it was very likely to come off any day. But we did not see any reason to think that either he or the other Mahommedans who are in the service of Russia would have felt the slightest doubt as to their duty to continue to serve in her armies. This Colonel was a particularly bright and pleasant fellow, and had a considerable knowledge of English literature; he could read it only in translations, still he knew

many of our best books, and was disposed to be particularly friendly to Englishmen. He made it his business to do all he could for us, and furnished us with a detachment of soldiers and horses to take us up the mountain. We started on the 11th of September from Aralykh, and rode during the day up to a place on the little plain between Great and Little Ararat, which goes by the name of Sardar Bulakh, where there is a Cossack station, with two tents and seven or eight men, posted there to watch the robbers and predatory Kurds who hover about the skirts of the mountain. We slept there, and started at one o'clock in the morning, by a pale crescent moon, to make our way to the foot of the great cone. We walked all night, but very slowly, because the Cossacks who accompanied us were extremely lazy, and insisted every ten minutes or so on sitting down and resting for a quarter of an hour. They were pleasant enough fellows, but they would not carry anything. I suppose they would have thought it beneath their dignity; and, in order to get the night wrappings and food which we required carried up, we had to engage four Kurds, each of whom took a burden on his shoulders and walked along with the Cossacks. Thus, we were a party of twelve or fifteen in all. About seven o'clock in the morning, when the sun had risen more than an hour, we reached a spot at the foot of the great cone, where the Cossacks stopped and intimated pretty clearly that they would go no further. We were quite unable to communicate with them, because although we had brought an interpreter as far as Surdar Bulakh, he was unable to come any further up, and we were left with these six Cossacks and four Kurds, unable to hold any communication whatever. We had each learned some few words of Russian, but they were only the names of things, or adverbs, or interjections, and did not go very far towards enabling us to keep up a conversation. However, the Cossacks found no difficulty at all in explaining to us that they would not go higher, because they simply sat down, and no efforts we could make by way of shaking them or pulling them, or taking out money and showing it to them, had the slightest effect in inducing them to move. I succeeded, however, I suppose more by example than by exhortation, in getting one Cossack and one Kurd to come along with me. My friend, who was not in trim for mountain-climbing, stopped at a height of about 11,500 feet, at eight o'clock in the morning, and this Cossack and the Kurd followed me further up towards the summit.

I ought to tell you that the mountain in this upper part is perfectly bare of vegetation, and consists mainly of ridges of bare rock,

separated by "screes" of loose stones. There are large beds of snow, which run down for a great distance from the top to a height of about 11,000 or 12,000 feet—long narrow beds occupying hollows between prodigious crests of rock, which look like great ribs standing out along the main body of the mountain; and one has one's choice to ascend along these snow-beds, whose inclination is pretty steep, or else along the rocky ribs that divide them, or along slopes of bare, loose, broken stones from which the snow has melted in the later autumn. Of these three I chose the loose stones, because the snow-beds, although easier when you have a party that can cut steps, are more difficult for a man going alone. I was therefore obliged to climb up these acclivities—cataraacts you might almost call them—of loose stones, whose angle was so steep as to make progress extremely fatiguing. When I got to a height of 13,000 feet, the Cossack and the Kurd sat down once more, and obstinately refused to stir a step. I gave up the Kurd, because he was a wild sort of creature whom one could not expect to have any influence over; and the Kurds, I ought to tell you, have fearful superstitions about the mountain: they believe it to be infested by Djinn, or devils of different kinds, and they think it excessively dangerous for men to be wandering alone upon it; I was therefore surprised at getting the Kurd to come up as far as he did. As for the Cossacks, although their mythology is somewhat different, they, too, believe in sundry spirits haunting the mountain, perhaps angels, because the Armenians, at any rate, think the mountain is guarded by angels who watch over the Ark, which is preserved in perfect repair in one of the highest recesses, secluded from mortal eyes. When the Cossack and the Kurd stopped, I was obliged to go on alone, and from that point to the top of the mountain I had to persevere pretty steadily, going very slowly, but hardly ever stopping, because, of course, it was more a race against time than anything else; and what I really was afraid of was missing the way and not reaching the bottom at the point where I left my friend, until it should be dark. As you know, in those latitudes, the twilight is very much shorter than it is with us, so that it does not do to be caught far away from your night-quarters when the sun begins to sink. The upper part of the mountain offers difficulties, but not many dangers: that is to say, the danger lies chiefly in the solitude and in the immense height to which one has to ascend; but there are not many of those dangers—seracs, bergschrunds, and so forth—with which we are most familiar in the Alps, though now and then there are bits of rock-climbing that want care. I was able to ascend, going very little upon the snow

until I got near the top, and therefore I had not much fear of crevasses. I was able, for the most part, to avoid dangerous precipices, and therefore there was no risk of breaking one's neck. The danger that one really did incur, which I cannot disguise, was that if anything had happened to me—if I had sprained my ankle or anything of that kind—I might be lying there now, because I do not suppose that my friend would have found it possible to induce the Cossacks and Kurds to come in search of me. The last part of the ascent, when I ceased to clamber slowly up these masses of loose stone, was upon a slope of rotten rocks—a curious kind of rotten rock which I have seldom seen elsewhere. It does not exactly consist of loose stones, but rather of a soft, sulphurous rock, crumbling away under one's feet, and therefore giving an extremely bad hold. This was excessively fatiguing, but it was the more so as the air at that height had become extremely rare. Those of you who have made lofty mountain excursions, know that upon some mountains, or to some persons, the rarity of the air offers a very serious difficulty in climbing. I never experienced it before, even on the highest summits of the Alps, but upon Ararat it was so painful that I was obliged to halt and take breath every two or three steps. It was about two o'clock when I got near the top of this long and trying slope of loose, rotten rock. One could just see the edges of the plateau of snow, and hanging on the plateau of snow a curtain of clouds. What there might have been behind it was impossible to say. The whole way up I had never seen the top; I had merely seen lines of rock running up, and apparently converging towards some lofty point, and near the converging point this mantle or table-cloth of snow, and resting upon it these thick white clouds; so that by the time I had got to the top of the slope of rocks, and on the edge of the snow, I had begun to fear that there might be a snow-cone above, and it was then so late in the day that it seemed hardly possible that I should succeed in reaching the summit after all. But to my great surprise, after getting on to the snow, and into the clouds, and walking for about five minutes over the snow, which was nearly level, I saw the ground begin to fall away to the north, and all on a sudden there came a strong blast of wind which swept the clouds off, and I could see upon the north side the valley of the Araxes lying at a prodigious depth, and beyond that the summit of Alagoz, and away to the north-east the snowy summits of the Caucasus. A few minutes after, another blast of wind cleared the air a little more to the west, and I perceived the second summit, which lies separated by about a quarter of

a mile from the first, which I had reached. Descending a little valley that lies between the two, and walking to the other, I got to the highest point. That was about half-past two in the afternoon.

The view was perhaps less grand and striking than one might have expected. It was of course very extensive. One could see as far as the Caucasus on the north, a distance of about 250 miles. One could see the highest ranges of mountains round Erzeroum to the west; and south as far as the mountains of Assyria, and Southern Kurdistan, mountains visible from and bordering the valleys of the Tigris and Nineveh, and the Zab. To the east, there were the enormous mountain masses of northern Persia, which run from Djulfa away out as far as the shores of the Caspian. The view, therefore, was very extensive, and it was, of course, wonderfully grand. There was a sense of expanse, solitude, vastness, which I never before experienced on any other mountain summit. But in point of beauty and picturesqueness it suffered by being too high. Those of you who are familiar with mountain ascents, must know that there is a point at which the colour of the objects that lie below almost disappears. One is able to make out outlines, but one can no longer discover those varieties of colour which give delicacy and charm to the landscape. At the height at which I stood, the distinctions of colour were almost obliterated; in fact, the tender colours, the greens and the soft greys, which one wishes to relieve the stronger hues on high mountains, had disappeared, and all that one could see was patches of snow here and there on the loftiest peaks, and interminable wastes of barren red, or brown, or yellow mountains—mountains of inexpressible sternness, mountains that seemed blank and shapeless, mountains which one could see must be of a great height, but which lay so heaped and tumbled together that it was almost impossible, even with a map in one's hand, to identify any particular peak.

I was fortunate enough to find a shorter way down the mountain, and succeeded in regaining my friend, who had remained at the height of 11,500 feet, at half-past six in the evening—only just in time, because the sun was setting, and it was so dark that one could hardly find one's way. We descended the next day to Aralykh, and from that made our way homewards by way of Erivan and Tiflis to the coast of the Black Sea.

Sir HENRY RAWLINSON said he had been more or less connected with Armenia for the last forty or forty-five years, and he was glad to bear testimony to the value and the correctness of the observations of Mr. Bryce with regard to the Armenians and Kurds. He knew the Armenians

thoroughly well. Acting in an official capacity in Turkish Arabia for twelve years, his public business had been wholly transacted by them. When Consul-General at Bagdad, he had a Consul, a Vice-Consul, or Cancellier, and four clerks, who were all Armenians, and their work was well and efficiently performed, but they required looking after. With a chief who would look after them, they were the best working Orientals with whom he was acquainted; but without such supervision matters were apt to go wrong. No doubt, as Mr. Bryce had said, it would be desirable to look after their future in any arrangement that might be made in consequence of the present war; but he did not see how, being but a small proportion of the inhabitants of the modern Armenia, they could have anything like autonomy. They were also, it should be remembered, exceedingly jealous of the Russians, and of any interference with their Church. They regarded their own Patriarch of Echmiadzin as a superior person to the Patriarch of the Russians, and consequently they were not thoroughly trusted by the Russians. It was possible that in the future they might (as Mr. Bryce suggested) form a sort of barrier to further Russian advance. It was also true that the country was, financially, worthless. Although Russia might annex the whole country as far south as Lake Van, it could never pay financially; but it would pay politically, in the "prestige" which it would confer. It would enable Russia to overlap the most fertile province of Persia (Azerbiján) to the extent of 100 miles. The frontier from Báyzíd to Lake Van took all the important Persian positions in flank, and its possession would place Russia in a far more powerful and menacing position than she at present occupied. He agreed with what had been said as to the bloodthirstiness and ferocity of the Kurds, but they had some good qualities. Some of the happiest days he had passed in the East had been in the castles of Kurdish chiefs. When their evil passions were not aroused by plunder or fanaticism, they were amongst the most agreeable Orientals, more like Europeans; and they had a high sense of honour among themselves. A Kurdish chief having given his word of honour to a brother chief, never forfeited it. He did not quite agree with Mr. Bryce in some of his remarks about Mount Ararat. He knew something of the mountain himself, having in 1834 made an abortive attempt to ascend it. It was too late in the season, and, finding it impossible to reach the summit, he only went up a short distance; but in 1846 his brother-in-law, Mr. Danby Seymour, ascended the mountain, and wrote a letter from the summit, which was still in the possession of his family. The mountain in question, however, had nothing whatever to do with the biblical Ararat. No one who had really gone into the question could doubt that the popular notion was a fallacy. The mountain had never been called Ararat in the country from the remotest times to the present day. The name was Aghri-Dagh, and Ararat did not apply to that part of Armenia at all. The history of those countries from the earliest antiquity, was now, owing to the decipherment of the cuneiform inscriptions, almost as well known as that of Greece or Rome. There were contemporary annals of Assyria, dating two thousand years before Christ, in all of which Ararat was as often spoken of and marked geographically as was Nineveh or Babylon. It was the name of a province which might be called Southern Armenia. It never extended further north than Lake Van, but included what was now called Persian Kurdistan, being the country east of Nineveh, and between the valley of the Tigris and the Persian plateau. In the Chaldean legend of the Flood, made known by the late Mr. George Smith, the Ark was made to rest upon Mount Nizir, which was explained to be another name for the range of Júdí. It was immediately east of the basin of the Tigris, in the very centre of the province called Ararat—so called, it must be observed, not in one or two solitary instances, but throughout Assyrian history; the name, moreover, having been taken up by the Greeks, and passed

on to the Armenians. Even in the geography of Moses of Chorene, the province of Ararat had nothing to do with Northern Armenia. The mountain, north-east of Mosul, which, at the present day, concentrated in itself all the biblical traditions referring to Ararat, was still called Jebel Júdí, and was visited by thousands of pilgrims annually in search of relics of the Ark, who bore away with them amulets made of small portions of wood which they found at the top of the mountain, no doubt supplied periodically by the priests. The practice had been going on for centuries, and was mentioned over and over again in history. He had himself seen troops of pilgrims going to the mountain of Júdí from all parts of the East. Until the third century, indeed, there was no notion of the northern mountain representing the biblical Ararat. It first arose in the Armenian Church. The Armenians having established the high place of their religion at Echmiadzin, in the immediate vicinity of the mountain, and having such a magnificent peak at their disposal, naturally appropriated it as the scene of the great biblical event, the greatest in the history of mankind. From that time the belief in the northern Ararat had been prevalent in the Armenian Church, but it had never been adopted by any other Christians of the East, nor by any of the Greek or Latin geographers. There was no notice, indeed, in classical geography which could possibly be made to refer to the northern mountain of Aghri-Dagh as representing the culminating peak of Western Asia. That, however, in no way detracted from Mr. Bryce's great merits in ascending the mountain, which was a most laborious feat to perform. The mountain itself was certainly most interesting and most beautiful. He knew nothing, indeed, more striking than the view of Ararat, with a cap of clouds on its snowy peak, which could be seen at a distance of at least 100 miles.

Mr. DOUGLAS FRESHFIELD said there was only one point on which he differed a little from Mr. Bryce in regard to Mount Ararat. That gentleman, he thought, had somewhat underrated the flora of the mountain. He had himself been in the country, but too early in the spring to ascend to the summit of the mountain: the heavy snow-fall of the winter was just melting. At a height of between 7000 and 9000 feet there appeared to be a tolerably abundant Alpine flora, including a kind of gentian. Dr. Radde, an eminent botanist, who with Herr Abich represented science at Tiflis, had, he believed, catalogued the flora of Mount Ararat. He would not enter into the discussion with regard to the Ark. Tradition had doubtless fixed Noah's Ark on the pedestal it deemed most worthy of it, in the same spirit in which it had removed Prometheus from a rock near the Euxine, and placed the scene of his torment now on Kazbek, now on Elbruz. Mr. Bryce had said nothing about the glacier on Ararat. It was the only one in the whole of Armenia. It was on the north side of the mountain in a narrow chasm, and there was some question whether it was not of the kind known as a *glacier remanié*. It had been sometimes said that there were other glaciers on Alagoz; but, in a pamphlet recently published by Dr. Abich on the Armenian mountains, it was stated that the glacier on Ararat was the only one in Armenia.

Mr. BRYCE, in replying, said he was highly gratified at having his statements confirmed by such high authorities as Sir H. Rawlinson and Mr. Freshfield were in their several ways. With regard to the flora of Mount Ararat, he was far from saying that it was not interesting: all he meant to convey was that it was not so interesting as might have been expected from the position and height of the mountain. He noted a good many Alpine species, mostly belonging to the same genera, such as *Cerastium*, *Draba*, *Gentiana*, *Astragalus*, as one finds on the Alps or on our own Highland mountains. He could confirm Mr. Freshfield's statement that there was no glacier on Alagoz. From the top of Ararat he looked into the central hollow

of Alagoz: there were patches of snow, but nothing like a glacier. With regard to the question raised by Sir H. Rawlinson as to Mount Ararat, if time had permitted he should have been delighted to discuss it with him at full length, beginning at Berosus, and going on to Nicolaus of Damascus, Moses of Chorene, Leo Africanus, and others, down to Dr. Theodor Nöldeke, who had written a valuable monograph on the subject. He could not admit that any other Ararat had superior claims to the mountain of which he had been speaking, and for which he might consider himself to hold a brief. He was not ignorant of the difficulties of the question; and, so far from having, as Sir H. Rawlinson seemed to think, merely assumed that the modern Ararat, Massis, is the true Ararat, he had dealt with the question fully in a book which he published a few months ago under the title of 'Transcaucasia and Ararat.' Those who were interested in the question would there find the claims of Jebel Jûdi discussed, and dismissed. He hoped that the arguments there advanced would, at any rate, have the effect of leaving the question in doubt. As to the pilgrimages made to the mountains in Southern Kurdistan, Berosus stated that in his time the people carried away, not only wood, but the pitch with which the Ark was smeared, and used it as a sovereign remedy for the cure of diseases. Berosus and the Assyrians had put their peak down in Southern Kurdistan; but he maintained that the author of the book of Genesis may well be held to have been better informed, and that the Ararat of the Bible, which was also the Ararat of Moses of Chorene, pointed to and was the true northern Ararat, and had nothing to do with the Assyrian one.

The PRESIDENT congratulated Mr. Bryce on meeting with a better fate than Dr. Parrot, since no one doubted that he had made the ascent he had described in his interesting lecture, for which he proposed the cordial thanks of the members.

Eighth Meeting, 11th March, 1878.

FRANCIS GALTON, Esq., F.R.S., in the Chair.

PRESENTATION:—*Francis Hallowes, Esq.*

ELECTIONS:—*Henry Byng Banks, Esq.; Harry William Birks, Esq.; Major George Robert Stewart Black; John Bowles, Esq.; James Comp-ton Burnett, Esq., M.D.; Frank Hedges Butler, Esq.; William Alexander Duncan, Esq.; Richard Clarke Downer, Esq.; Hon. Thomas Elder; Lieut. Hon. Fitzwilliam Elliot (93rd Highlanders); James Galbraith, Esq.; Major Edward Smith Gordon, R.A.; Lieut. John Macpherson Grant (92nd Gordon Highlanders); Colonel James T. Griffin; George Jinman, Esq.; Rev. Donald Dimsdale Mackinnon, M.A.; Alexander McAlister, Esq.; William Henry Muggeridge, Esq.; George Oliver, Esq.; George William Paine, Esq.; Rev. Canon Prothero, M.A.; George Reynolds Sharp, Esq.; George Thomas Wickenden, Esq., F.Z.S.; Colonel Wilkinson.*

DONATIONS TO THE LIBRARY, FROM 25TH FEBRUARY TO 11TH MARCH, 1878.—Sailing directions for the Dardanelles, &c., 2nd edn., 1877 (*The Lords Commissioners of the Admiralty*). Annuaire pour l'an 1878 (*Le Bureau des Longitudes, Paris*). Tasmania, Western Country: Reports by the Hon. J. R. Scott and Mr. C. P. Sprent, 1877 (*H.M. Sec. of State for Colonies*). General Report on the province of Kordofan, by Major H. G. Prout; Cairo, 1877 (*General C. P. Stone*). On Spelling Reform, by A. V. W. Bickers, 1877 (*Author*). L'Année Géographique, 2^{de} série, I.; Paris, 1878 (*M. H. Duveyrier*). Memorials of Service in India, by W. Macpherson, 1865 (*Author*). Reports on trade at the Treaty ports in China for 1876; Shanghai, 1877 (*R. Hart, Esq., Inspector-Gen. of Customs, Pekin*). Creation and Providence, by J. E. Howard, 1878 (*Author*). The literature of the Polar regions, by J. Chavanne, A. Karpf, and F. C. de Le Monnier; Vienna, 1877 (*The Vienna Geographical Society*). L'Afrique et la Conférence géographique de Bruxelles, par E. Banning, 2^{ie} éd. n.; Bruxelles, 1873 (*Author*). Astronomical observations made at the Royal Observatory, Edinburgh, XIV. (*The Astronomer Royal for Scotland*). U.S. Geographical and Geological Survey of the Rocky Mountain region, J. W. Powell, Geologist in charge. Contributions to North American Ethnology, vol. I.; Washington, 1877. Report on the Geology of the Eastern portion of the Uinta Mountains, with Atlas; Washington, 1876. Preliminary Report on the Palæontology of the Black Hills, by R. P. Whitfield; Washington, 1877. Outlines of the Philosophy of the North American Indians, by J. W. Powell; New York, 1877 (*J. W. Powell, Esq.*). Memoria acerca de los Terrenos de Metlatoyuca, por Ramon Almaraz, Mexico, 1866; Informe general que instruyo el Marqués de Sonora al Virrey Bucarely y Ursua, 1771; Annales del Ministerio de Fomento de la República Mexicana, I. and II., 1877; Memoria del Ministerio de Fomento, 1865, 1868-69, 1873; Boletin del Ministerio de Fomento de la República Mexicana, vol. I., and 8 nos. of vol. II.; Geografia de las lenguas y Carta etnografica de Mexico, 1864, and Memoria para el plano de la Ciudad de Mexico, 1876, por M. Orozco y Berra; Memoria para servir a la carta general de la República Mexicana, por A. Garcia y Cubas, 1861; Viaje a la Caverna de Cacahuamilpa, por M. Barcena, 1874; Importancia de Mexico para la Emigracion Alemana, por C. Sartorius, 1852; and Memoria sobre la determinacion astronomica de la Ciudad de Cuernavaca, por F. Jimenez, 1866 (*el Ministro de Fomento, Colonizacion, &c., de la Republica Mexicana*). And the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM BETWEEN FEBRUARY THE 25TH AND MARCH 11TH, 1878.—Language Map of India and the Border lands, and Language Map of Further India and the Indian Archipelago (*R. N. Cust, Esq.*). Equatorial Africa, 3 copies (*James Fergusson, Esq.*). Rufu or Kingani (*F. Holmwood, Esq.*). Nos. 17, 18 and 19 of Spruner's Hand-Atlas (*Justus Perthes*). United States Charts, 1 sheet (*Commodore R. H. Wyman, U.S.N.*). Addenda to Dr. Ami-Boué's Itineraries in European Turkey (*Dr. Ami-Boué*). Sheet 1 of Map of Turkey in Europe (*Quartermaster-General's Department*). Admiralty Charts, 9 sheets (*The Hydrographer*).

THE CHAIRMAN said the honorable charge of giving the second of the series of lectures on scientific branches of geography had been assigned by the Council to Captain Evans. It was unnecessary to remind the Meeting of Captain Evans's intimate connection with magnetic science for many years; a science which peculiarly lay within the province of that great Department over which he so worthily presided—the Hydrographical Department of the Admiralty.

The following Lecture was then delivered by the Author:—

The Magnetism of the Earth. A Lecture on the Distribution and Direction of the Earth's Magnetic Force at the Present Time: the Changes in its Elements, and on our Knowledge of the Causes.
By Captain F. J. EVANS, C.B., F.R.S., Hydrographer of the Admiralty.

THE Fellows of the Society will recollect that in the introductory lecture on Scientific Geography given in February, 1877, by our colleague General Strachey, it was assumed that the outline so graphically sketched by him, should be filled up in detail by succeeding lecturers. The Magnetism of the Earth, as having an unusually close connection with the progress of geographical research, and especially so with the art of navigation, was then prominently brought to our notice: and now, in the opinion of the President and Council, the time appears to have arrived for an exposition of the details, and this duty has been confided to me.

But here, at the outset, a few preliminary remarks are necessary. Magnetism, so far as in its essence and nature it is capable of being grasped by the human mind, appears illimitable. It may be described as one of those great forces of nature everywhere and at every moment exerting influence; for the magnetic condition of all matter has been demonstrated by modern science, and no doubt remains as to the universality of the force. The consideration of this broad generalisation is, however, outside the subject matter of this lecture: which comprehends only the magnetic condition of

our globe, in so far as it is exhibited in that kind of magnetism principally resident in iron. A simple conception of this magnetic condition is, that by the agency of a distinct force in nature, one particle of iron is attracted by another particle of iron, and that these particles may be retained in vertical suspension the one from the other in opposition to the force of gravity.

The magnetic force of the Earth, or what we commonly speak of as Terrestrial Magnetism, is perhaps most familiar to us as being that energy which causes the compass needle to point in a fixed direction : but it has other effects, and one of these specially affects navigation ; for, from its capacity to impart a kindred force to iron, an iron ship in the process of building acquires what may be termed a magnetical "constitution," and this constitution, whether by time or circumstances, is never afterwards parted with. In this case we have the ship's magnetic force superimposed on the Earth's force, and most complicated phenomena, so far as the action of the compass is concerned, follow : fortunately these are reducible to law, and so can be provided against by skilled appliances.

The mariner's compass, even in its most primitive form, has been a marvellous agent in facilitating the progress of the human race. Its influence on the world's history, by opening up the navigation of the oceans and thereby the knowledge of remote countries, cannot but be recognised by geographers ; and therefore all that we can learn of the laws affecting its action, and by what means and under what conditions these laws have been developed ; what we know of them in our own generation, and what is concealed from us by a mysterious veil which as yet we cannot penetrate, are subjects which may be considered not unworthy of attention.

HISTORICAL SKETCH FROM THE TIME OF THE DISCOVERY OF THE DIP OF THE MAGNETIC NEEDLE.

About three hundred years ago the fact was becoming familiarly known to those interested in travel, whether by sea or land, and thus to the geographers of the day ; that a bar of iron, when freely suspended by a thread through its centre of gravity,—and so taking up when at rest a position indefinite as to direction,—would, when rendered magnetic by the touch of the loadstone, no longer remain at rest parallel to the earth's surface, but incline at a constant angle to it ; as also that it finally rested in a definite direction. The angle that the inclined bar makes with a hori-

zontal line in the same vertical plane, and the angle between that horizontal line and another in the astronomical meridian, being known respectively as the "*dip*" and "*variation*" of the magnetic needle.

These two elements of dip and variation became thus associated in men's minds, although seamen had known fully a century earlier that the variation of the compass had not a constant value, but changed as their ships altered their geographical position. This fresh knowledge gained as to the action of magnetised iron, excited the attention of the philosophers of the period, and the year 1600 marks an epoch in magnetical science. Dr. Gilbert of Colchester, physician both to Elizabeth and James I., then published a treatise in Latin, '*On the magnet (or loadstone), and magnetical bodies, and of that great magnet, the Earth.*'* He clearly pointed out for the first time the magnetic properties of the earth; its inductive action, as exemplified on the upright iron bars in the crosses on old church towers, rendering them, in short, magnets; and demonstrated that the earth, by its directive force, performed relatively to the compass needle the office of a real magnet. Gilbert stood high among his contemporaries and admirers, some of whom ranked him with Harvey—the discoverer of the circulation of the blood—with Galileo and Descartes. Galileo himself, the famous astronomer, regarded Gilbert "as great to a degree which might be envied."

During the 17th century, our seamen, in their then newly-opened navigation to the East and the West, diligently made observations at sea of the dip and of the variation of the compass. We find, for example, in the early part of the century, Henry Hudson and others making special determinations of the dip in the Spitzbergen and Nova Zembla seas; men's minds had already become familiar with some of the marvels of magnetism and their practical bearings on navigation. Towards the close of the century, Halley, one of the most distinguished men of science of the day, presented to the Royal Society two papers [1683 and 1692], the first giving a theory of the variation of the compass; the second, an account of the cause of the change of the variation of the needle, with an hypothesis concerning the structure of the internal parts of the earth. Halley subsequently added materially to the observations made by the old navigators—on which his theories were based—for the Government recognising the value of his labours, gave him a ship of war and a commission

* '*De magnete, magneticisque corporibus, et de magno magnete tellure: Physiologia nova, plurimis et argumentis, et experimentis demonstrata.*' Londinis, Anno 1600.

as a naval captain to command her, in order to make a voyage of research. On the completion of this voyage, which embraced both shores of the Atlantic, Halley compiled a magnetical chart, including also the Indian Ocean, wherein the variation of the compass was shown by a system of connecting lines, drawn through the positions where equal values had been determined by actual observation. This proved a valuable adjunct to navigation.*

Hereafter I shall have to refer to the remarkable hypothesis advanced by Halley, concerning the magnetic condition of the earth, and of the causes of the changes in the direction of the needle at the same geographical position; suffice it here to say that on this subject, in common with all those who have studied the matter even to the present time, he was sorely perplexed. Halley foresaw that the minds of many generations would be exercised in arriving at a sound theory, and wisely appealed to "all masters of ships, and all other lovers of natural truths," diligently to make observations of the compass variations in all parts of the world, and to communicate them to the Royal Society, "in order to leave as complete a history as may be to those that are hereafter to compare all together, and to complete and perfect this abstruse theory."

Halley's appeal was not in vain; those glorious navigators of the eighteenth century,—Wallis, Carteret, Cook, D'Entrecasteaux, La Pérouse, Vancouver,—were diligent observers. Their results, with those of their no less worthy predecessors in the seventeenth century,—Davis, Baffin, Keeling, Narborough, Tasman, Dampier—have been in later times collected by the able and diligent Norwegian magnetician, Hansteen, and embodied by him in a series of magnetical charts (dip and variation) for several distinct epochs, ranging between the years 1600 and 1787.†

In the eighteenth century, the almost microscopic movements of the compass needle from hour to hour were detected, and its daily oscillations during the several months of the year were recorded in London. Towards the end of the century, doubts began to arise as to the invariability of the earth's magnetic force, the assumption that it was so invariable at all points of the earth's surface having apparently, until then, been generally accepted. Humboldt, during his American travel (1798–1803), devoted much time, when in the equatorial regions, to the elucidation of the facts, and he clearly traced that the earth's magnetic force increased with the latitude.

* See Plate I., for similar Lines of Equal Variation drawn for year 1878.

† '*Atlas: Magnetismus der Erde.*' Christiania, 1819.

This brings us to the present century. Within its first quarter, a few earnest thinkers discerned in the slow and mysterious daily movements of the needle, and in the suggestion that they were regulated by a law, some possible connection with the sun and other bodies in space; and that these mysterious relations implied cosmical influences which might some day be found to pervade the whole universe.

An impetus to inquiry at this juncture was not wanting from the navigators' point of view. The voyages of Ross, Parry, and other worthies to the Polar Regions—primarily undertaken to open a passage between the Atlantic and Pacific Oceans—passed near the region where subsequently it was found that the dipping needle stood vertical, and where, as the consequence, all directive action on the horizontal or compass needle vanished. The seamen were naturally embarrassed with this, to them, novel condition of navigation; the opportunity was therefore eagerly seized for making many observations in this exceptional magnetic area. In one of these Arctic voyages [1831] James Ross planted the British flag on what he assumed to be the Magnetic Pole. Here let me incidentally mention that it is to a then young captain of artillery who accompanied Parry in his earlier voyages [1818–20], Edward Sabine, and who is still among us one of the most honoured veterans of science, that this country is deeply indebted for much that has been done in advancing our knowledge of Terrestrial Magnetism.

Encouraged by the ardour of Humboldt and by the additions resulting from voyages and land journeys in which magnetical observations were special objects, new lines of observation and experimental research were now undertaken by Continental philosophers; refined instruments for detecting the minutest movements of the needle and for measures of the earth's force in reference to a fixed standard were devised by Gauss, of Gottingen, a physicist and mathematician of profound ability; and simultaneous watchings, rigorous in character, were established at localities on the European continent widely distant from each other.* This devotion was soon rewarded, for it demonstrated that the needle moved in obedience to one and the same law at stations the most remote from each other. At times, too, a certain agitation of the needle was detected;

* '*Intensitas vis magneticæ terrestris ad mensuram absolutam revocata*; auctore, Carolo Friderico Gauss.' Gottingæ, 1833.

'Results of the Observations made by the Magnetic Association in the year 1836.' Gottingen. Edited by C. F. Gauss and W. Weber. See Taylor's 'Scientific Memoirs.'

it then appeared to be tremblingly alive to some sudden shock or impulse from without. Occasionally these trembling oscillations were of unexpectedly large angular values. The periods of large oscillations were also found to be often synchronous at the remotest stations. So striking and general were these disturbances, that they were aptly designated "magnetic storms." It was further observed that the most violent storms of wind appeared to be wholly without influence, provided the needle was effectually protected from any effect of their direct mechanical action: as with *wind* storms, so it was with *thunder* storms, which even when close at hand exercised no perceptible influence on the magnetic needle.*

These phenomena, so deeply interesting in their nature, engaged in this country the attention of the Royal Society, and of the British Association for the advancement of Science. A combined plan for extending observational operations was arranged with the leaders of the original movement in Germany and Russia—Humboldt, Erman, Gauss, and Kupffer; this country being represented by Professor Lloyd of Dublin, and Sabine. Appeals to Government for support in aid of a national scheme for making observations of the three magnetical elements by land and by sea were made, and promptly attended to. By the year 1840, four well-equipped observatories had been established in our colonial possessions. Toronto in Canada, and Hobarton in Van Diemen's Land, were selected as being antipodal. St. Helena and the Cape of Good Hope had also their special recommendations. The East India Company equipped three stations, and a Hindu native prince munificently added another, at Trevandrum, in his own territory. Russia established some ten or twelve; extending from Finland to Eastern Siberia, and from St. Petersburg to Tiflis, and even one at Pekin. In various degrees most of the Continental Governments, and also the United States of America, joined in the movement.

To Great Britain, as the chief maritime State, was allotted the collection of observations in the southern hemisphere, more especially in those oceanic regions which, from their high latitudes, were unlikely to be visited in commercial interests. An expedition, consisting of two ships under James Ross, quitted our shores in 1839 for an exploration of the South Polar seas, and returned in 1843, having well fulfilled its mission. The high dip of nearly 89°

* Extended modern observations would appear to verify these results. The late distinguished Roman astronomer and physicist, Father Secchi, however, held the opinion that relations existed between magnetical and meteorological phenomena.

was attained, and thus the south magnetic pole nearly reached—a close approach to the position of vertical dip being rendered impossible by massive barriers of ice.

From 1835 to 1845 was thus a time of unparalleled activity in the extension of systematic and accurate magnetical observations over the earth's surface. At the same time a remarkable region in British North America was examined in detail; so also were the British Islands; and from that time to the present, magnetical surveys of limited areas in all parts of the world have been and are being made. Numerous State observatories, equipped with self-recording instruments, are now dotted over the globe. Observations at sea, too, are not disregarded. The recent *Challenger* expedition, for example, throughout the voyage, contributed almost daily perfect observations, and the late Arctic expedition did good service.

The work of the four colonial observatories, comprising in some cases a period of eight years, as also the results of the Antarctic expedition under James Ross, and the observations of other navigators in all parts of the world during the past fifty years, have been closely analysed by Sir Edward Sabine. These laborious analyses, given to the world in a series of volumes, and in papers in the 'Philosophical Transactions of the Royal Society,' form a solid and enduring foundation for the activity of coming generations in this field of inquiry, and will long keep in memory the perseverance and clear intellect of one among the foremost magneticians of the century. The latest and not the least valuable of these contributions by Sabine to terrestrial magnetism, is a magnetic survey of the earth's surface for the epoch 1842-3, chiefly derived from the sources just mentioned. It embraces the three elements: *Declination*, *Inclination*, and *Intensity*—terms which, in the language of modern science, take the place of the old and time-honoured words of *variation*, *dip*, and *total force*.

Having thus rapidly passed in review the progress of this science during three centuries, and explained how the vantage-ground we now stand on was from time to time approached—a review indeed necessary for an intelligent appreciation of the breadth and depth of our subject—I proceed first to the consideration of some general principles, and then to the leading features of the distribution of magnetism over the surface of the globe, as we find it in our own day.

MAGNETS, THEIR CHARACTERISTIC FEATURES : THE COMPASS AND
DIPPING NEEDLES.

Gilbert's affirmation,—made, as I have related, so far back as the year 1600,—that the earth by its directive force performed relatively to the compass needle the office of a real magnet, was a bold and a fairly accurate generalisation. With this generalisation in view, it is important that clear conceptions should be entertained of the analogy existing between the magnetic character of the earth and that of an ordinary bar-magnet: I venture therefore, at the risk of being deemed to have entered unduly into elementary details, to enlarge somewhat on this point.

It is no doubt a familiar fact to most present, that a steel bar can be rendered magnetic by various well-known artificial means; and that when so excited, two opposite and equal forces are produced at each end, one acquiring that kind of magnetism which is called north, the other south magnetism. Also that the N. end of one bar will repel the N. end of another bar, but attract its S. end, and *vice versa*.

There are other characteristics of a magnetic bar deserving, for our purpose, special mention. If we suspend this bar so as to move like the compass needle in a *horizontal* plane, the N. (or marked) end will always point towards the magnetic north, the other end towards the magnetic south. We are here assured that the force by which the bar assumes this definite position is not an attractive but a *directive* force; because while it attracts one end of the bar it equally repels the other, so that on the whole the suspended bar is not drawn either to the north or south. Another characteristic is, that the points of the bar magnet in which the attractive and repulsive forces may be considered as concentrated, are situated just within the ends. These imaginary points are known as the *poles* of the magnet.

To prepare ourselves for a familiar conception of the earth's magnetism, one more elementary proposition must be advanced:—the action, under certain conditions, of magnets on each other.

If we take a bar magnet, and suspend over its entire length a number of small magnetic needles by their centres and thus free to move in every direction, this will be the result: at the N. pole of the bar the S. end of the adjoining suspended needle will be attracted; at the S. pole of the bar the N. end of the adjoining suspended needle will be attracted to that pole. The suspended needle near the centre of the bar will take up a position parallel to the bar, with its poles *opposed* to that of the bar; the needles

suspended between either pole and the centre of the bar will incline or dip at various angles, dependent on their relative distances between the poles and the centre of the magnet. We have in this simple illustration, easily verified by experiment, a series of results analogous to the direction and angular amount of the "dip" of the needle to be found extending from magnetic pole to magnetic pole on the earth's surface.

Keeping the illustration in view, let us now see where are those places situated geographically at which a freely suspended needle would take up a vertical position, in the one case with its *N.* end downwards, in the other with the *S.* end downwards, and where would it assume a horizontal position.*

To the *N.N.W.* of Hudson's Bay, in lat. 70° *N.*, long. 96° *W.*, the *N.* end of the needle points vertically downwards, *i.e.* the dip is 90° . To the south of Tasmania, in lat. $73\frac{1}{2}^{\circ}$ *S.*, long. $147\frac{1}{2}^{\circ}$ *E.*, the *S.* end of the needle points vertically downwards. These are the earth's magnetic poles. [See Plates II. and III.]

The line of successive places round the globe where the same freely suspended needle takes up a horizontal position (its *N.* end always pointing towards the magnetic pole in the northern hemisphere), lies near the geographical equator. In the Atlantic and eastern half of the Pacific Ocean it is to the south; in the Indian and western half of the Pacific Ocean it is to the north of the geographical equator. By analogy this encircling line of no "dip" is known as the "magnetic equator." [See Plates II. and III.]

A few explanatory words on the "dipping" needle are here necessary. Wishing to observe the full effect of the earth's magnetism, we must not only allow the needle to move in a horizontal plane, as in the compass; but must also allow it freedom of movement in a vertical plane. The dipping needle is the instrument employed for thus measuring the angle which the *N.* end of a compass needle would take up were it permitted to move in a vertical plane.

ON THE "LINES OF FORCE" OVER THE GLOBE.

We must now advance another stage in our definitions. The direction assumed by a freely suspended needle (*i.e.* one capable of

* As the magnetism of the North end of a needle is of the opposite kind to that of the North Pole of the earth, physicists are not agreed as to which should be called *North* magnetism; and it has therefore been found convenient to distinguish them by colour, calling the first red, the second blue. The distinction may be easily remembered by supposing the needle coloured, and from *R* occurring in *n*o*R*th and in *R*ed; *U* in *s*o*U*th and in *b*l*U*e.

moving freely about its centre of gravity in all directions), in obedience to the earth's magnetism, is known to science as the "line of force." This line of force, as we know by the action of the compass in nearly all parts of the globe, diverges to the east or west of the geographical or true north. By the action of the dipping needle the "line of force" is further found to be only horizontal in the equatorial and tropical regions, and to lie below or above the horizontal plane when to the north or south of the magnetic equator.

Observations made of these "lines of force" all bear the same testimony. If we follow the direction of the horizontal (or compass) needle, we are invariably led to the two points where the needle takes up a vertical position; in other words, to the magnetic poles: when thus mapped, the earth's surface is traversed from north to south and south to north by a system of imaginary lines converging to two points, analogous to the representation on maps of geographical meridians and poles. [See Plate II.]

As to similar teachings of the "dip" of the needle: if lines traced on the earth's surface where the "dip" is equal in amount are followed, we shall always be led in a series of circular or elliptical paths round the adjacent magnetic pole, but not reaching it: here an analogy to the geographical parallels of latitude is obvious, as these vary from 0 at the terrestrial equator to 90° at the terrestrial poles; similarly the angle of dip from the horizon, which is zero at the magnetic equator, becomes 90° at the magnetic poles. [See Plate II.]

Thus far, in what may appear elaborated detail, but not more than is necessary to a clear conception of our subject, the general distribution of the "lines of force" as represented on maps, and the terms "magnetic" poles, meridians, parallels, and equator, have been explained.

ON THE DISTRIBUTION OF MAGNETIC FORCE OVER THE EARTH'S SURFACE.*

We have now to enter on another, and possibly, as ultimately bearing on sound theory, the most important phenomenon in Terrestrial Magnetism. This is the distribution of magnetic force over the earth's surface: and here it is well to again revert to the simple bar-magnet for illustration.

The magnetic power of the bar, though, in fact, distributed throughout its mass, acts in an approximate way as if concentrated

* See Plate III.

at points (*the poles*) just within the ends. We may assume, as indeed cannot be doubted, that the magnetic power of the earth is distributed throughout its mass; this being so, a concentration of force would, as in the bar, exist at two points or poles in each hemisphere. To a limited degree such is the case, inasmuch as the numerical value of the force at the magnetic poles is twice as great as at the magnetic equator; but here we are confronted with a fact, divergent in a striking degree from our conceptions derived from a bar-magnet. The maximum magnetic force of the earth does not occur at the magnetic poles, nor does this force appear to be associated directly with the "lines of force" as indicated by the freely suspended needle. Observation proves that the two elements—*Intensity* and *Inclination*—(*i.e.* total force and dip), vary, independently of each other, with the position of the place of observation; and there is no such connection as would justify the one being spoken of as an immediate function of the other.

Observations made with rigid accuracy show us where these regions of maximum force are situated at the present time. In the northern hemisphere there are two of these regions: they are widely separated and of unequal power. The stronger of the two is situated to the south-west of Hudson's Bay, near the great system of the North American lakes; its central part is in lat. 52° N., long. 92° W.: this is known as the American focus of force. The weaker, or the Siberian focus, may be assumed to be near the mouths of the River Lena, in lat. 65° N., and long. 115° E. Geographically these foci of force are thus far distant from the north magnetic pole.

In the southern hemisphere, the central part of the region of maximum force is to the south of Australia, and may be considered in 65° S. and 140° E. The indication of a second focus is scarcely, if at all marked; if, however, from analogy as to what exists in the northern hemisphere, we assume there is one there, it is scarcely if at all weaker, and is alone separated from the major focus by 15° of latitude, and 20° of longitude, which would place it in 50° S. and 120° E. Geographically, therefore, these foci are not far distant from each other, or from the south magnetic pole, thus differing markedly in their terrestrial distribution from the two foci in the other hemisphere.

The term power, or force, or intensity, as we here apply it to denote these attributes of a bar-magnet, or of the earth considered as a magnet, is indefinite, unless numerical values are attached to convey ideas of the relative power of their several parts. We state, in general terms for example, "that the intensity of each point in

the axis of a linear magnet is proportional to the square of the distance from the magnetic centre," or "the force in the axis increases as the square of the distance from the middle point," and I have already incidentally remarked that the earth's magnetic force is twice as great at the magnetic poles as it is at the magnetic equator; but these values are only relative, and fail to give the conception which might be found in absolute numbers based on some invariable standard or unit.

Modern science, in its demands for exactitude, has devised instruments for the determination of the earth's magnetic intensity in real absolute measure. In this country, the units of force to which these intensities are referred, are the unit of mass (a grain), the unit of time (a second), the unit of space or length (a foot). Thus, in London, at the present time, the *absolute* intensity in the line of force (or, as sometimes expressed, "total force," to distinguish it from its component parts vertical and horizontal) is 10·28; that is to say, it may be conceived as a force capable of generating in a mass of one grain, a velocity of 10·28 feet in one second.*

In these numbers, then, the values of the two foci of the force in the northern hemisphere are respectively 14·2 (American), 13·3 (Siberian). In the southern hemisphere the Antarctic focus has a value of 15·2:—the magnetic charge, if we may apply the term, of the two hemispheres, is thus seen to be sensibly different.

The lowest force observed in any part of the globe in absolute measure is 6·0: this region is on the west side of the Atlantic Ocean, between the parallels of 15° and 25° s.

If we trace over the earth's surface lines of the "total force" of equal value as we have done in the case of magnetic meridians and parallels, some singular anomalies in their symmetrical arrangement present themselves, and especially so if the analogy of arrangement in a magnetic bar be kept in view. We have seen that these lines indicate in the northern hemisphere two centres of force, and what in strictness can alone be termed one centre of force in the southern hemisphere; and all these are shown to be unconnected with the magnetic poles. The result is that the lines of equal force have no relation with the lines of equal dip, inasmuch as they do not run parallel with each other. But the most remarkable diver-

* The units of length and weight adopted in foreign measures are the millimetre and the milli-gramme. To convert a numerical value obtained on the British system into the corresponding value obtained on the foreign system, the British number must be multiplied by ·46108; or to convert the foreign system into the British, multiply by 2·1688.

gence from symmetrical arrangement in the distribution of the earth's force, is in its inequality, if we divide the globe into eastern and western hemispheres; in which case the one hemisphere is stronger than the other, in the proportion of 4 to 3. In the hemisphere comprising the Pacific Ocean, with Eastern Asia, Australia, and Western America, the *minimum* intensity expressed in absolute measure is 8. In the other half, including Europe, Africa, and the Atlantic Ocean, it is 6. Again, if we trace along the parallels of 60° N. and 60° S., in the central part of the Pacific Ocean, the values of the "total force" are respectively 12 and 14. In the central part of the Atlantic Ocean, on the same parallels, the respective forces are 12 and 10.

RESEARCHES ON THE NATURE OF TERRESTRIAL MAGNETISM,
AND ITS DISTRIBUTION.

Hypotheses have been advanced, and experiments made so far to discover the nature of terrestrial magnetism, as to whether it is produced in any important degree by magnetic forces external to the earth, such as electro-magnetic currents; whether superficial, or deep-seated. The arguments in favour of the first two assumptions are slender, and may here be passed by. Tobias Mayer in the last century, and Biot in the early part of the present, considered that the principal phenomena of the earth's magnetism could be explained by the action of a powerful magnet of limited dimensions near the centre of the earth. Hansteen (1813-19) investigated the effects of two small magnets within the earth and inclined to the earth's equator in different planes. Both of these hypotheses so far failed, that in special cases the results could not be reconciled with observations; though the broader facts of terrestrial magnetism were fairly represented. At the time of these later investigations but little was known of the nature of the distribution of force, but this defect as bearing on theory was soon to be removed—Sabine, in 1838, presented to the British Association an Intensity map for a great part of the earth's surface, accompanied with all the observations on which it was based and also some very able deductions. This marked an epoch.

In 1839, a general theory of terrestrial magnetism was given to the world by Gauss;* and here we begin to tread on firm ground. Gauss assumed, as the foundation of his researches, that the terres-

* * * *'Allgemeine Theorie des Erdmagnetismus.'* See translation in Taylor's *'Scientific Memoirs,'* with Supplement, vol. ii. (*'General Theory of Terrestrial Magnetism'*).

trial magnetic force is the collective action of all the magnetic particles of the earth's mass. Having before him fairly assured values of the *three* elements at some ninety points on the earth's surface, he on this data, by a geometrical investigation which has been characterised as "one of the most beautiful and the most important that has appeared for many years in physical mathematics," elaborated formulæ from which were obtained certain "constants" now known by his name. From calculations based on these "constants," results in terms of the magnetic elements were derived; these being then graphically rendered on charts, it was seen that the complicated phenomena of the magnetic lines, as broadly traced from actual observation, were reproduced with a remarkable approach to accuracy.

Among the important conclusions arrived at by Gauss in these investigations were: that the agents producing the magnetic force of the earth, or the greater part at least of them, are situated exclusively in the interior of the earth. The fallacy of the hypothesis which would place the cause of terrestrial magnetism in space external to the earth he considered as proved. Another result is very striking. Estimating the total magnetic power or "moment of magnetism" of the earth, as compared with that of a steel bar, one pound in weight thoroughly magnetised, he found the earth to be 8464 trillion times greater; or, supposing the magnetism of the earth to be uniformly distributed throughout its volume, it would be equal to eight such bars (more exactly 7.831) for every cubic metre.

It would be wearisome to enter on a description of the geographical boundaries and directions of the lines of the several magnetic elements, whether as represented by the theoretical deductions of Gauss, or drawn from observation: an inspection of the charts devoted to this subject will more readily convey to the mind their varying and complicated features. I am desirous, however, of pointing out some of the special characteristics that present themselves in the geographical distribution of the more marked phenomena.

As to the magnetic poles. We must not conceive these as absolute points on the surface of the earth, but rather as regions limited in area. That in the northern hemisphere has been traversed as well as encircled by many travellers and voyagers (James Ross, as we know, obtained in 1831 the dip of $89^{\circ} 59'$ in lat. $70^{\circ} 5' N.$, long. $96^{\circ} 43' W.$), and we are now fairly assured that the dipping needle stands as nearly vertical as can be shown by the best instruments, over an area of some fifty geographical

miles square. In this region we must remember that all compass action ceases, there being no horizontal force to give it direction.

The magnetic pole in the southern hemisphere has not been approached nearer than about 200 geographical miles; the highest dip recorded in the Antarctic voyage of James Ross, when in this position of lat. $76^{\circ} 30'$ s., long. $166^{\circ} 0'$ E., was $88^{\circ} 56'$; the assumed position for the needle standing vertical being then readily deduced from calculation.

As to the foci of the maximum force. These are large areas of nearly uniform value in absolute measure. The American focus is elliptical in form, and, as deduced from a large number of observations, the semi-axes of the ellipse are some 225 and 85 geographical miles long. The limits of the Siberian focus are but indefinitely determined. The region of maximum force in the southern hemisphere has a vast area; it may be considered as elliptical in shape, with values exceeding $15\cdot0$ in absolute measure, ranging over approximately 35 degrees of latitude and 50 of longitude.

The "magnetic equator" admits of being determined with great precision instrumentally, for the change from the well-marked amounts of 10° N. to 10° S. dip is, as a rule, included within 10° of latitude, *i.e.* in every minute of latitude the dip alters two minutes. The broad geographical features of this imaginary line are its devious courses on each side of the terrestrial equator.

Magneticians, whose opinions are entitled to respect, attach more value, on theoretical grounds, to the "dynamic" equator (*i.e.* to the line of least *total force*) than to the "magnetic" or "dip" equator. In my opinion the "dynamic" equator has no special bearing on any hypothesis connected with the subject; the reversal of the dip on passing from one hemisphere to the other is, however, a phenomenon having direct influence on the iron of a ship and thus sensibly affecting her magnetic character; and so far the "dip" equator becomes a zero line of some importance, at least from a practical though possibly secondary point of view.

On similar practical grounds the knowledge of the line of greatest horizontal force (*i.e.* the *horizontal* component of the *total force*) round the globe has interest, inasmuch as in its region the directive force acting on the compass-needle is at the maximum. The horizontal force diminishes as the magnetic poles are approached, and vanishes, we must remember, when they are reached; hence the sluggishness of the compass in high latitudes and its uselessness in the neighbourhood of the magnetic poles. This, as will be readily understood, arises not from any diminution of the magnetic force of the earth, for that increases as we go to the poles, but from its

direction becoming more and more inclined to the horizon. An interesting physical fact further exists in connection with the line of maximum horizontal force: it corresponds nearly with the mean annual line of greatest heat over the globe; and this latter, as we know, is, except in a limited region in the Eastern Archipelago, wholly to the north of the terrestrial equator.

As to the prime phenomena of the variation of the compass, it will here suffice to say the surface of the globe is, speaking generally, divided into two regions: one, the smaller, in which the variation is westerly; the other and larger, in which it is easterly. Westerly variation prevails in the Atlantic and Indian Oceans; easterly, in the Pacific Ocean. In all parts of the globe, open to ordinary navigation, the variation rarely exceeds 30° , it is only as we reach the neighbourhood of the magnetic poles that the larger values are to be found, and thus it is that our Arctic voyagers and travellers, traversing a comparatively small geographical area, record all values from 0 to 180 degrees of difference between the true and magnetic meridians.

This, limited by the time at my command, in many details, completes the tale of the earth's magnetism as we know it in our own day; a knowledge gained, as we have seen, by instrumental methods, which in their precision and number compare favourably with those made in astronomy, or indeed in any other branch of physical science. But our task is not completed; we have now to consider another and singular section of our subject.

MAGNETIC ELEMENTS IN A CONSTANT STATE OF CHANGE.

The magnetic condition of our globe, as represented by the three elements observed on its surface, is ever varying; but in what manner, or to what end, is unknown to us. For a clear conception of this singular physical fact, I would quote the words of a great philosopher* but lately passed away from us. He says, "The relations of terrestrial magnetism lie among those mysterious powers which seem to constitute the chief arcana of inanimate nature, and its phenomena form a singular exception to the character of stability and permanence which prevails in every other department of the general subject. The configuration of our globe; the distribution of temperature in its interior; the tides and currents of the ocean; the general course of winds and the affections of climate; whatever slow changes may be induced in them by

* Sir John Herschel. 'Quarterly Review,' 1841, Art. "Terrestrial Magnetism."

those revolutions which geology traces, yet remain for thousands of years appreciably constant. The monsoon, which favours or opposes the progress of the steamer along the Red Sea, is the same which wafted to and fro the ships of Solomon. Eternal snows occupy the same regions and whiten the same mountains, and springs well forth at the same elevated temperature from the same sources now as in the earliest recorded history. But the magnetic state of our globe is one of swift and ceaseless change. A few years suffice to alter materially, and the lapse of half a century or a century to obliterate and completely remodel, the form and situation of those lines on its surface which geometers have supposed to be drawn, in order to give a general and graphical view of the direction and intensity of the magnetic forces at any given epoch."

Sir John Herschel, in these eloquent words, refers to those great changes in the direction of the magnetic needle as observed during the historical period. Two or three examples will illustrate the nature and extent of these changes. In London, between the years 1580 and 1818, the pointing of the needle had gradually changed from $11\frac{1}{2}^{\circ}$ east of the terrestrial pole to $24\frac{3}{4}^{\circ}$ to the west (or an included arc of one-tenth of the circle). Then a brief pause in the annual movement ensued, which was succeeded by a retrogressive movement to the eastward, and the needle now [1878] has gone back from its westerly maximum to $18\frac{1}{2}^{\circ}$ w., and we may believe that the grand oscillation will continue until the easterly maximum is again arrived at. In the southern hemisphere, at the Cape of Good Hope, the needle pointed directly to the terrestrial pole in the year 1608; in 1840 it pointed 29° to the west of it. There was then a pause in movement, and afterwards a slow progression in the same direction. The variation now exceeds 30° .

Similarly with the dip of the needle:—from the year 1576, when it was first observed in London that the north end inclined below the horizon [$71^{\circ} 50'$], the amount increased till about 1723 [$74^{\circ} 42'$]; since then it has gradually and uniformly decreased from 2 to 3 minutes a year, and now stands at $67\frac{3}{4}^{\circ}$.

Philosophers, the most conversant with magnetical science, declare their inability to divine the nature of the causes which in such brief spaces of time effect so material an alteration in the direction of the magnetic forces. M. Arago, who took a very active part in making observations between 1815 and 1835, writes: "Nothing in the vast domain of terrestrial physics is more obscure and more uncertain than the causes which everywhere occasion the three elements of terrestrial magnetism, viz., the declination, inclination, and

intensity of the force to vary." Sir Edward Sabine, writing some twenty years later, "All attempts that have hitherto been made to connect the secular magnetic change with any other physical phenomena, either terrestrial or cosmical, have signally failed." This is so important a branch of our subject, that I must again revert to it; in the meantime it is necessary we should distinguish these "secular" changes, as they are termed, from those constant but slow movements of the needle which specially attracted the attention of men of science in the early part of this century.

MOVEMENTS OF THE MAGNETIC NEEDLE DEPENDING ON THE EARTH'S POSITION IN REGARD TO THE SUN.

Some of the, to them, mysterious movements, and which may be truthfully termed microscopic, are by comparatively recent investigation found to correspond in period to the earth's revolution round the sun and to its rotation on its own axis. The simplest classification of these movements are thus included in a day and in a year. Taking first the daily movement of the compass or variation needle: in the middle latitudes of the northern hemisphere, the *N.* end of the needle at about 8 A.M. points generally farther to the east than at any other hour of the day; it then gradually moves to the westward till about 1½ P.M., when it attains the farthest westerly position; between this time and the following morning, the long march to the east is interrupted towards the midnight hours by a short one to the westward. In the middle latitudes of the southern hemisphere the movements of the *N.* end of the needle are in the opposite directions, for there it is the *south* end of the needle that is obedient to this law of movement.

In the low latitudes, such as at St. Helena, Singapore, and especially at Trevandrum, the daily movements of the needle conform alternately to the general movement in either hemisphere, according to the season of the year. Thus between May and September the movement has the characteristic march of the northern, and from October to March that of the southern hemisphere.

The diurnal affections of the dip and total force, though very small in value, are found obedient to law, having their well-marked periods of maximum and minimum values.

Directly connected, however, with these diurnal movements of the needle, being as it were intermixed with them, are those dependent on the position of the sun in respect to the earth's equator; these superimposed values are thus classified as "annual" in distinction to the "diurnal," the latter being chiefly dependent

on the sun's hour angle at the time of observation, the "annual" being dependent on the earth's position in his orbit.

All the magnetic elements are distinctly affected in the earth's yearly revolution, and we must remember that their observed phenomena *are common to the whole globe*. Thus in the pointing of the N. end of the needle; when the sun is north of the equator it stands to the east, and when the sun is south of the equator to the west of its average position, the turning-points approximating to the equinoxes. Similarly with the dip: the inclination (of either end of the needle) is greater during those months when the sun is south of, than during those months in which he is north of the equator, and passes through its mean values about the time of the equinoxes.

Generalising, the following law obtains for both hemispheres: *when the earth is nearest to the sun and therefore moves with the greatest velocity in its orbit, then the magnetic force is the greatest, and the direction of the needle approaches nearest to the vertical.*

SUN (AND MOON) DO NOT ACT DIRECTLY ON THE EARTH AS MAGNETS.

In the various discussions of philosophers on these movements of the needle, an inclination to ascribe them to the heating powers of the sun acting successively on different parts of the earth's surface has prevailed; but the generalisation just given is a forcible argument against the sun's thermal action as the sole cause. On the other hand, there is reason to believe that no analogy exists between the sun's action as influencing the magnetic condition of the earth, and the action of a magnet on a mass of soft iron placed at a great distance from it: nevertheless the movements described are certainly due to the sun's direct action, and a conjectural view is, that the influencing forces proceed from the sun in a form different from that of magnetic force, to which they become converted by their action on the matter of the earth or its atmosphere.

Modern investigation has further brought to view that a magnetic influence is exercised by the moon. Everywhere and in each of the three elements manifestation of her action is sensibly felt though in a minute degree.* In a lunar day, between each two successive passages of the moon over the meridian of the observing station, the direction of the needle has two epochs of greatest easterly and two epochs of greatest westerly pointing; the intermediate changes of direction being continuous and progressive.

* See especially Mr. Broun's investigations; Edin. Royal Soc. Trans., vol. xxvi., 1872; and Proceedings Royal Soc., London, 1872, pp. 756-758.

The same reasoning as to the sun's magnetic action is applicable to that of the moon's, for we are told on competent authority that she must be a magnet, thousands or millions of times more intense than the earth, to produce a sensible effect of the character of any of the observed terrestrial disturbances.*

ON THE DISTURBANCES AFFECTING THE MAGNETIC NEEDLE.

The magnetic disturbances, to which I shall presently refer, would certainly appear from their periodicity to result from the sun's power, whether it be magnetic or otherwise: and that this power varies with the size and frequency of the openings in the sun's outer envelope, as evidenced to us by the spots on its surface, is an accepted fact. Here we have a curious episode in magnetical science. It was the favourite occupation of an amateur astronomer (Schwabe of Dorpat) to watch from day to day and record the spot groups on the sun's disc. After an experience of some twenty-five years in this self-imposed and apparently unremunerative task, he was in a position to announce to the astronomical world that there was law and sequence in the distribution and numbers of these spots; in short, that in a cycle of some ten or eleven years their alternate increase and decrease were presented with unfailing regularity. At about the time of this announcement [1850], Sabine had analysed the observations made at the colonial observatories; he had remarked that year by year the disturbances of the magnets varied in number and magnitude, and this without grounds for suspicion of the existence of instrumental or observational errors: and comparing then cautiously the yearly ratios of these disturbances in the frequency of occurrence and amount of aggregate effects with the yearly ratios of Schwabe's sun-spot record, he established an identification of the most confirmatory character; and thus an unsuspected cosmical influence, differing from gravitation and very mysterious in its nature, was brought to view.†

These magnetic disturbances may be described as sudden and abrupt changes taking place in the earth's magnetism and not unfrequently occurring simultaneously over all parts of the globe. The disturbing force is of a throbbing or pulsatory character; under its influence the needle oscillates in a capriciously rapid manner, now

* Mr. C. Chambers and Sir William Thomson, *Phil. Trans.*, 1863. Art. xxiii.

† See also on this subject a valuable discussion by J. A. Broun, F.R.S., "On the decennial period in the range and disturbance of the diurnal oscillations of the magnetic needle and the sun-spot area." *Edinburgh Royal Soc. Trans.*, vol. xxvii., 1876.

on the one side and now on the other of the normal position for the time. In the larger disturbances observed in this country, the intervals of smaller pulsations vary from about half a minute to four or five minutes; the longer period of pulsatory force lasting from forty to fifty minutes: a careful observer (Balfour Stewart) has described the smaller pulsations "as being superimposed on the larger, like ripples traversing the surface of a great ocean wave." The disturbances are obedient to law: for they have daily periods depending on the solar hours, and, as we have seen, the same decennial periods of maxima and minima as are manifested by the sun spots.* Every region, according to its geographical position, receives these shocks with distinctive effect: in one region they either press the needle's N. end to the eastward during the day hours, and to the westward during the night hours, or the reverse. The dip and the total force occasionally increase and also decrease in their mean values: or, again, in the day hours the maximum number of shocks will take place and in the night hours the minimum number: this action may be reversed, so that the phenomena, viewed as a whole, are extremely complicated.† In their aggregate sum the geographical relations are no less distinctly marked; in intertropical regions the amount is small, and augments in the middle latitudes: as the higher latitudes are approached the disturbances rapidly increase in intensity, but this intensity appears to vary in different meridians.

Perhaps their distinctive character will be more clearly understood if we broadly follow out the movements of the needle at stations, widely distributed. The experiences at Kew (near London), and at Nertschinsk in Eastern Siberia [117° of longitude apart]; at Toronto in Canada, and at Point Barrow near Behring Strait, the most northerly point of the American continent [28° of latitude and 77° of longitude apart], will illustrate the effects in the European, Asiatic and North American continents respectively.

At Kew the westerly deflections prevail during the hours of the *day*, the easterly deflections prevail chiefly during the hours of the *night*: there being a very slight preponderance of the easterly deflections. At the *same time* that the easterly disturbances at Kew are at their maximum—*i.e.* from 9 P.M. to 3 or 4 A.M.—the westerly disturbances in their maximum values are going on at Nertschinsk:

* Mr. Broun has established the mean duration of the decennial period of the magnetic disturbances to be 10.45 years—this being also accordant with the sun-spot period.

† The investigations of Mr. Broun would lead to the conclusion that the magnetic disturbances have their maximum effect near the equinoxes, and the minimum near the solstices.

the time of cessation or nearly so of these disturbances is, however, less distinctly marked; Kew is little affected between 9 and 11 A.M.; at Nertschink the quiescent period is some hours later. At the two stations, Toronto and Point Barrow, the easterly disturbances have their greatest development at times which are nearly 12 hours apart; and the westerly disturbances have their greatest development at the one station in the forenoon, at the other in the evening. Again, at the stations in North America, the easterly disturbances predominate in amount, while in Northern Asia the westerly predominate. In the southern hemisphere, westerly deflections preponderate at St. Helena, Cape of Good Hope, Hobarton; but at the Falkland Islands easterly deflections have the mastery, and thus are in accord with the North American stations. Sir E. Sabine has remarked on this, that so far as the phenomena are yet known the classification might rather be into *eastern* and *western* than into northern and southern hemispheres, the easterly deflections prevailing in the western or American hemisphere and the westerly deflections at the stations in the eastern hemisphere.

ON AURORAS AND EARTH CURRENTS AS CONNECTED WITH MAGNETIC DISTURBANCES.

Connected with these disturbances are auroral displays; excessive disturbances being accompanied with magnificent auroras which are visible at the same time in both hemispheres. This association is especially interesting: at Point Barrow where the recorded aggregate amount of disturbance greatly exceeds that found in any part of the American continent, even in the highest Arctic latitudes, there is a no less extraordinary prevalence of aurora, displays having been visible at this place during two winters [1852-54], for nearly one-third of the time that the hourly magnetic observations were in progress. The several Arctic voyagers—confined, it may be observed, between the 15th and 60th degrees of west longitude—from the early time of Parry to the recent time of Nares, have on the other hand, traced but little connection between the aurora and disturbances of the needle; while if we proceed farther east to the newly-discovered Franz Josef land (north of the confines of Europe and Asia) Weyprecht and Payer tell us that during the two winters they spent there [1872-74], “the northern lights shone with incomparable splendour;” that “the magnetic disturbances were of extraordinary magnitude and frequency,” and that they were closely connected with the aurora. (In all the disturbances observed in the Austrian expedition, the declination needle it is stated moved

towards the east ; at the same time the horizontal intensity decreased and the inclination increased.)

Connected too with the larger at least of the magnetic disturbances and more vivid auroras, are certain electrical currents passing through the surface materials of the earth which sensibly disturb telegraphic operations. The Astronomer Royal has devoted attention to this subject : he says, "that it is impossible to avoid the conclusion that the magnetic disturbances are produced by terrestrial galvanic currents below the magnets, though these currents will not account for all that are observed in the magnetometer records."* All that can be said at present is that earth currents are certainly obedient to law ; their records, however, throw no light on the sources of the ordinary diurnal inequalities of magnetism : neither do they bear out the supposition of Barlow and other magneticians, by accounting for the existence of the principal part of the earth's magnetism.

ON THE GREATER MAGNETIC CHANGES KNOWN AS "SECULAR"
CONSTANTLY GOING ON, AND HYPOTHESES CONCERNING THEM.

We have now passed in review the successive stages of development of our branch of knowledge, from the pregnant epoch when its principles were enunciated by Gilbert, till the period when the well-directed munificence of our own and other Governments dotted the earth's surface with observatories, and despatched land and sea expeditions, specially equipped, for the determination of the magnetic elements. We have seen how a few earnest and gifted men have, by long and patient analysis, laid the foundations for future generations to build upon as regards theory, and unravelled the apparently inextricable web surrounding the needle's daily and yearly movements ; tracing these movements to their primary source, the sun : and how by the perseverance of states and of individuals, we are now in possession of accurate knowledge as to the distribution of magnetism over the surface of our globe, as represented by the variation and dip of the needle, and by the measure of the force connected with those component elements. But the task, from a scientific point of view, is far from completed while we remain in ignorance of the causes of the greater changes in the earth's magnetism going on from year to year, and so on, possibly through æons of time. From a practical point of view, so far as the interests of man are concerned, the collection of records will be a never-

* Phil. Trans., Art. xvii. p. 471.

ending task, for every generation must observe and chart the magnetic elements of its time.

The subject of secular change is thus one of such great interest that the remaining portion of my lecture must be chiefly devoted to it. The active mind of Halley was drawn, as one of the first, to the probable nature of the causes: collecting such observations of the variation of the compass as had then been made, and projecting them on polar maps, he found that the convergence of the several directions of the needle led to two points in each hemisphere. On this he enunciated the proposition "that the whole globe of the earth is one great magnet, having four magnetical poles or points of attraction; near each pole of the equator two; and that in those parts of the world which lie near adjacent to any of these magnetic poles the needle is governed thereby, the nearest pole always being predominant over the more remote." Halley saw, as he confessed with despair, the difficulties attending the proposition "as never having heard of a magnet having four poles," but there were the facts manifested by the earth, and he was too sagacious and sound a philosopher to pass them by. He accordingly propounded a theory which, however fantastic it may now appear and perhaps did at the time he wrote, has nevertheless within it the fire of genius, and may probably yet be found to contain some sparks of truth. To account for the four poles, and at the same time for the secular change of the variation, he conceived that the earth itself might be a shell, containing within it a solid globe, or *terella*, which rotated independently of the external shell: each globe having its own magnetic axis, passing through the common centre; but the two axes inclined to each other and to that of the earth's diurnal rotation. It is not difficult to follow the movements of the consequent four imaginary poles in solution of the problem.

Hansteen working at the same problem a century after Halley [1811-19] and much on the same lines, came nearly to the same conclusion with regard to the four poles of attraction: and he rendered justice to Halley by recognising him as the first who had discovered the true magnetic attraction of the globe. Hansteen, with the material at his command, went however a step farther, and computed both the geographical positions and the probable period of the revolution of this dual system of poles or points of attraction round the terrestrial pole. From these computations he found that the North American point or pole required 1740 years to complete its grand circle round the terrestrial pole, the Siberian 860 years; the pole in the Antarctic regions south of Australia, 4609 years; and a secondary pole near Cape Horn, 1304

years.* The influence of these laborious investigations on the minds of subsequent inquirers may easily be imagined.

The matured views of Sir Edward Sabine on the secular changes—enunciated in the clearest manner in 1864–72—are deserving of the highest consideration. An ardent admirer of the genius and no less of the sagacity of Halley, he in part follows Halley's views, and considers that two magnetic systems are directly recognisable in the phenomena of the magnetism of the globe; the one having a terrestrial, the other a cosmical origin. The magnetism *proper* of the globe with its point of greatest attraction (*i. e.* in the northern hemisphere) in the north of the American continent is the stronger; the weaker system, or that which results from the magnetism induced in the earth by *cosmical action*, with its point of greatest attraction is, at present, in the north of the Asiatic continent. Sir Edward Sabine also expresses his belief that “it is the latter of these two systems which by its progressive translation, gives rise to the phenomena of secular change, and to those magnetic cycles which owe their origin to the operation of the secular change.”†

Reviewing these several hypotheses by the light of observations made in recent years, it is difficult, and indeed in some directions, impossible, to recognise their accordance with changes now going on: there can be no doubt, notwithstanding, that Halley and Hansteen analysed their facts with skill, and that their deductions were borne out by those facts. In explanation of this anomaly it is necessary to glance retrospectively on the changes in progress at the times in which these philosophers gave utterance to their views [1700–1819]. During this long interval, and, so far as relates to parts of the northern hemisphere, for a century before, there was in the higher latitudes a general movement of the N. end of the needle in the following directions:—

Over all that area (embracing the Atlantic and Indian Oceans) from Hudson's Bay to about the meridian of the North Cape of Europe, and from Cape Horn to about the western part of Australia, the N. end of the needle was successively drawn to the west at a maximum rate of 8' or 10' a year. From the meridian of the North Cape of Europe to that of 130° E., it was successively drawn to the east, while from thence to Hudson's Bay it was nearly stationary, or perhaps oscillated a little: in the southern hemisphere, from about the western part of Australia to Cape Horn, the

* ‘*Untersuchungen über den Magnetismus der Erde.*’ Christiania, 1819.

† Phil. Trans., 1864, Art. vi.; 1868, Art. xii.; 1872, Art. xvi.

movement was throughout to the east at the maximum rate of about 7' a year. There was thus a general uniformity of movement : in that hemisphere [dividing the globe into *eastern* and *western* hemispheres] which includes the Atlantic and Indian Oceans, the needle was constantly drawn more and more to the west ; in the hemisphere embracing the Pacific Ocean more and more to the east.

So far then to the early part of the present century we can trace a harmonious movement of the needle over the whole globe, justifying the conclusions of our old philosophers ; but in the year 1818 at London, and generally contemporaneous with that epoch throughout Europe and North Africa, the westerly progress of the N. end of the needle ceased, and an easterly movement commenced ; this continues to the present time, and with a yearly increasing rate. But in the South Atlantic during this period the westerly movement has never ceased ; it is still going on, and in some parts with rapidity. Here, then, is a marked dislocation of the harmonious regularity embodied in Halley's and Hansteen's calculations and conceptions.

The matured views of Sir Edward Sabine, to which I have drawn attention, seem to anticipate the difficulties attendant on this new and complex movement ; for, if I apprehend his meaning correctly, they imply that the poles of attraction which have a terrestrial source, *i.e.*, the *magnetic poles*, are not subject to translation.*

The hypothesis, if further followed, is nevertheless beset with difficulties ; for we can scarcely conceive changes due to *cosmical* action to be otherwise than general in character, and to affect the whole globe. Thus, if the progressive translation of the induced or weaker system in Northern Asia—and presumably of that in the southern hemisphere—were the direct causes of the secular changes, we should anticipate uniformity in the general movements of the needle as manifested by its variation and dip over the earth's surface. But this is contrary to modern experience ; for in some regions great activity of movement, both in the direction of the pointing and in the inclination of the needle, is going on ; in others there is comparative repose in both elements ; while in another region the needle remains nearly constant in its direction, while its inclination sensibly varies from year to year. For example :—

A region of remarkable activity presents itself in the South Atlantic Ocean : a great part of the seaboard of South America

* So far as modern observations bear on the position of the magnetic poles, they indicate permanency rather than change of place.

extending to Cape Horn, and including St. Paul's Rocks, Ascension, St. Helena, and the Falkland Islands, with their adjacent seas, are embraced therein. In some parts of this area the westerly movement of the needle exceeds 7' or 8' a year, and has so progressed for nearly three centuries. On the American coast the dip of the s. end of the needle *decreases* from 7·5' to 4' yearly, while from the Cape of Good Hope to Ascension it *increases* from 5' to 10' yearly. We have here, within narrow limits, a noteworthy dislocation of the observed phenomena.

Another region of activity, so far as are denoted by the changes of variation, extends over Europe, Western Asia, and North Africa. Here the needle, in opposition to the protracted westerly movement going on in the South Atlantic, commenced moving to the eastward in the early part of this century; it has a progressive rate which in some parts now amounts to 10' a year. The dip diminishes in this region seldom more than 3' a year.

A region of activity, so far as the dip is concerned, but with little change in the variation, is to be found on the west coast of South America; at Valparaiso, as at the Falkland Islands, the south dip decreases at the rate of 7' yearly, but in sailing northward and reaching the 10th degree of south latitude, this active movement appears to cease.

But little activity in either element now exists over the habitable part of the North American continent or in the West Indies. Throughout China there is little change in the variation, but an *increasing* dip of 3' or 4', and thus a reverse movement to that going on in Europe.

Over a great part of the Western Pacific Ocean, as also in Australia and New Zealand, there is so little change in the two elements that this may be termed a region of comparative repose.

These are a few facts relating to secular changes going on in two magnetic elements within our own time; and what are the inferences to be drawn therefrom? They appear to me to lead to the conclusion that movements, certainly beyond our present conception, are going on in the interior of the earth; and that so far as the evidence presents itself, secular changes are due to these movements and not to external causes: we are thus led back to Halley's conception of an internal nucleus or inner globe, itself a magnet, rotating within the outer magnetised shell of the earth.

We need not here pause to discuss the probability of this fanciful conception of the old philosopher, but proceed to examine how far

the behaviour of another element, the intensity of the earth's magnetism, confirms the view that movements are going on in the interior of our globe. In common I believe with all those who have pursued the study of this element from the time when Sabine's original memoir to the British Association [1837] threw so much light on this special division of the subject, I had conceived that stability, within very limited conditions, was a distinctive condition of the earth's force; and that it was alone by watchful attention to the instruments of precision devised for its determination that changes in short intervals of time, such as a generation, could be detected.* If we turn to the results obtained in this country through nearly half a century, it is possible that an *increase* of two or three hundredths of the total force may be found. In Italy at the present time the annual *decrease* has been given by that active observer, the Rev. Father Perry, as $\cdot 004$; so also on the North American continent, where, as we are told by the zealous magnetician, Schott, there is evidence of the force slightly increasing at Washington, of being stationary at Toronto, in Canada, and slightly decreasing at Key West, in the Gulf of Mexico. So far, stability, within very small limits, obtains over a large part of the northern hemisphere. If, however, we turn to the continent of South America and its adjacent seas (parts of which are regions of marked activity as denoted by changes in the variation and dip of the needle), we shall find a diminution of the intensity of the earth's force now going on in a remarkable degree; an examination of the recent observations made by the *Challenger's* officers† at Valparaiso and Monte Video, compared with those made by preceding observers, show that within half a century the whole force has respectively diminished one-sixth and one-seventh—at the Falkland Islands one-ninth. Farther north we find at Bahia and Ascension Island, in the same period of time, an equally marked diminution of one-ninth of the force. This area of *diminishing* force has wide limits; it would appear to reach the equator and to approach Tahiti on the west and St. Helena on the east: at the Cape of Good Hope there is evidence of the force *increasing*.

Such are the facts, and how are we to interpret them? Which-

* The investigations of that able magnetician, Mr. Broun, lead him to consider that the earth's magnetic force increases and diminishes from day to day by nearly the same amount over the whole globe. These increases and diminutions have been traced to the action of the sun in such a way that the greatest of them recur frequently at intervals of 26 days, or multiples of 26 days—a period attributable to the sun's rotation.

† This extended and carefully made series are prepared for publication; we cannot too highly estimate this valuable contribution to magnetical science.

ever way we look at the subject of the earth's magnetism and its secular changes, we find marvellous complexity and mystery; lapse of time and increase of knowledge appear to have thrown us farther and farther back in the solution. The terella of Halley, the revolving poles of Hansteen, and the more recent hypotheses of the ablest men of the day, all fail to solve the mystery. We must not, however, be discouraged at these repulses in the great conflict for the advancement of human knowledge. The present century has been productive of keen explorers in the field of terrestrial magnetism; others emulous of fame are pressing rapidly from the rear, and knowing as we do that knowledge shall be increased, we may confidently anticipate the day when this, one of Nature's most formidable secrets, shall be revealed.

The CHAIRMAN said they had listened with great interest and instruction to this comprehensive epitome of the present state of our knowledge of magnetic science, which when printed would form a most valuable addition to the publications of the Society. Perhaps the leading idea that Captain Evans's remarks had left in their minds referred to the strangeness and magnitude of the earth's magnetic force, of whose primary causes our ignorance was almost absolute. Very little was known of the causes even of the magnetic storms, and nothing whatever of those of the secular changes. There was therefore a wide field for future research in a primary geographical subject. They were irresistibly led by what they had heard to think of the fluid interior of the globe, and of the vast changes that were slowly going on beneath its surface. He was sure that all present would agree in returning thanks to Captain Evans for his address.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Barometric and Hypsometric Observations to fix the Height of Demavend.* By Captain the Hon. G. NAPIER.

Gulahek, near Teheran, Persia,
September 4, 1877.

To the SECRETARY of THE ROYAL GEOGRAPHICAL SOCIETY.

SIR,—The following barometric and hypsometric observations which I have lately had the opportunity of making on the peak of Demavend may possibly prove of interest. The barometric observations are, I believe, the first ones made on the summit of the crater. The Italian Scientific Expedition of 1863 carried a barometer as far as the foot of the crater, where it was broken. The remaining altitude was computed, and, judging by my own

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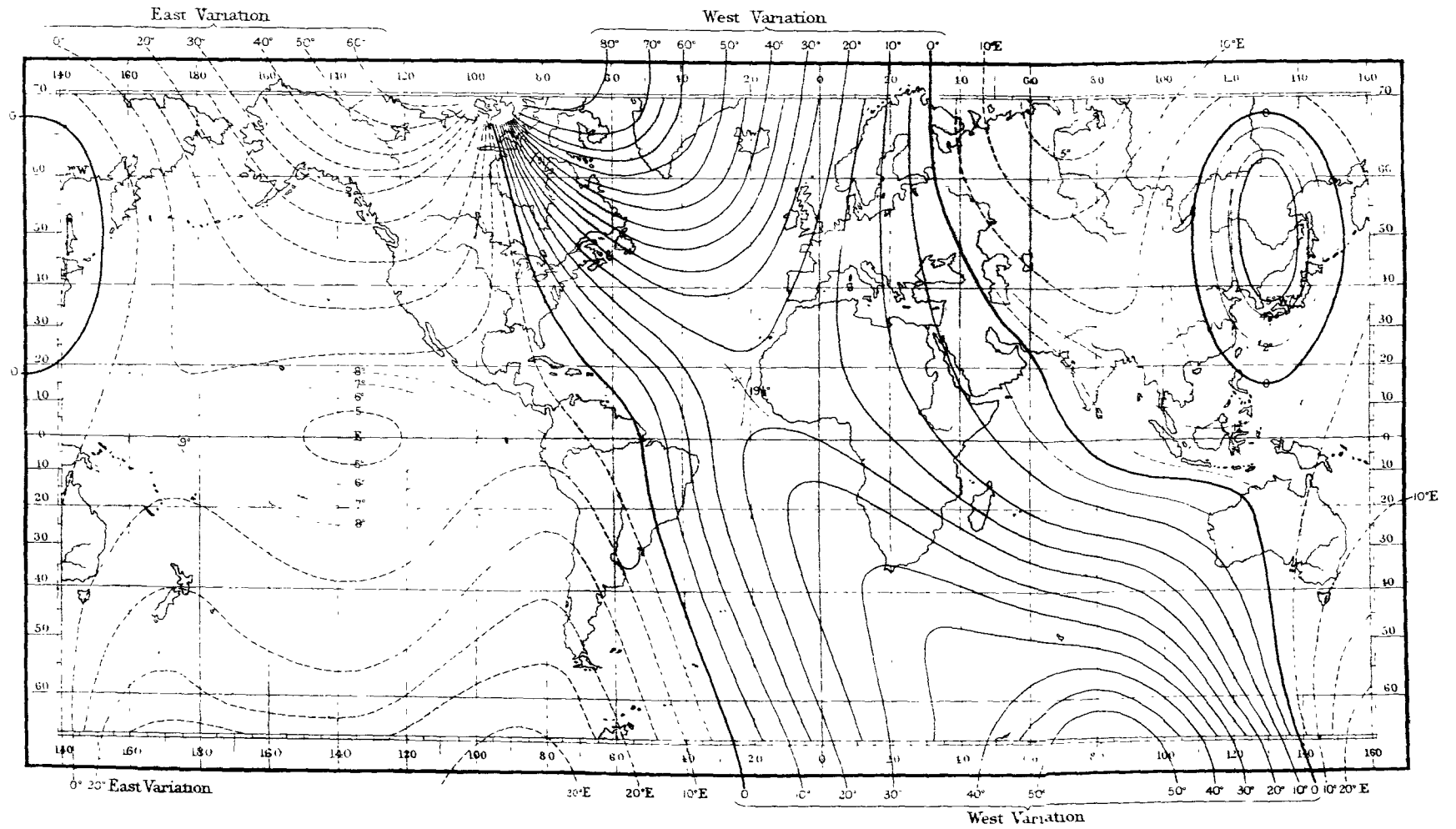
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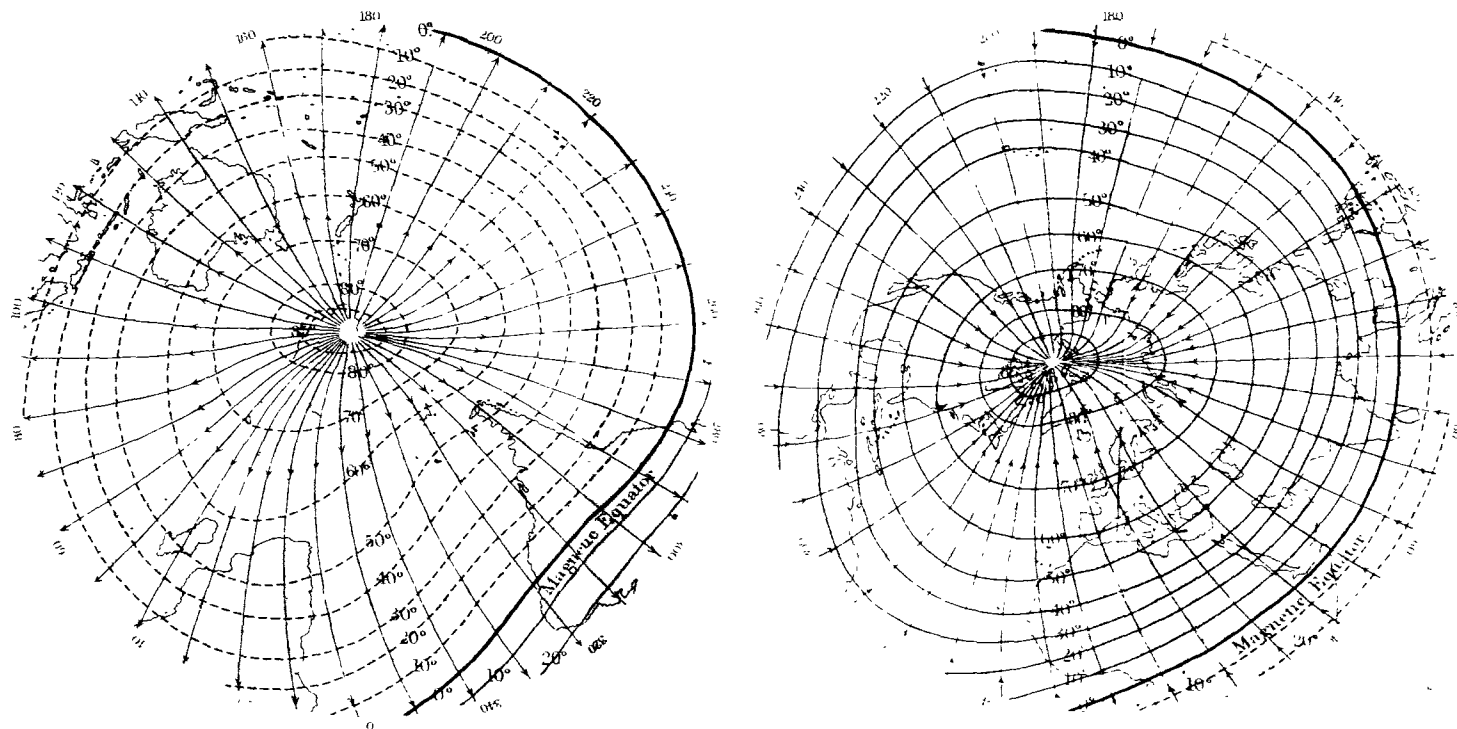
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LINES OF EQUAL MAGNETIC VARIATION, OR DECLINATION (ISOGONIC LINES) 1878.



TERRESTRIAL MAGNETIC MERIDIANS, AND CURVES OF EQUAL DIP, OR INCLINATION (ISOCLINAL LINES) 1878
 (WITH THE MAGNETIC POLE IN EACH HEMISPHERE)



1. The Magnetic meridians, — or lines showing the angle made by the line of force with the Geographical meridians — are marked with arrow heads. The arrow heads also show the direction of the North end of the compass needle.
2. Curves passing through points of equal North Dip are shown by continuous lines. South dip by broken lines.

1

THE EARTH'S MAGNETISM.

AS SHOWN BY

- 1 The distribution of lines upon the Earth's surface passing through points of equal Total Force in 1878,
(The force being expressed in Absolute measure, British units.)
- 2 The position of the Magnetic poles and the line of no dip, or the Magnetic Equator.
- 3 The regions of blue and red Magnetism.

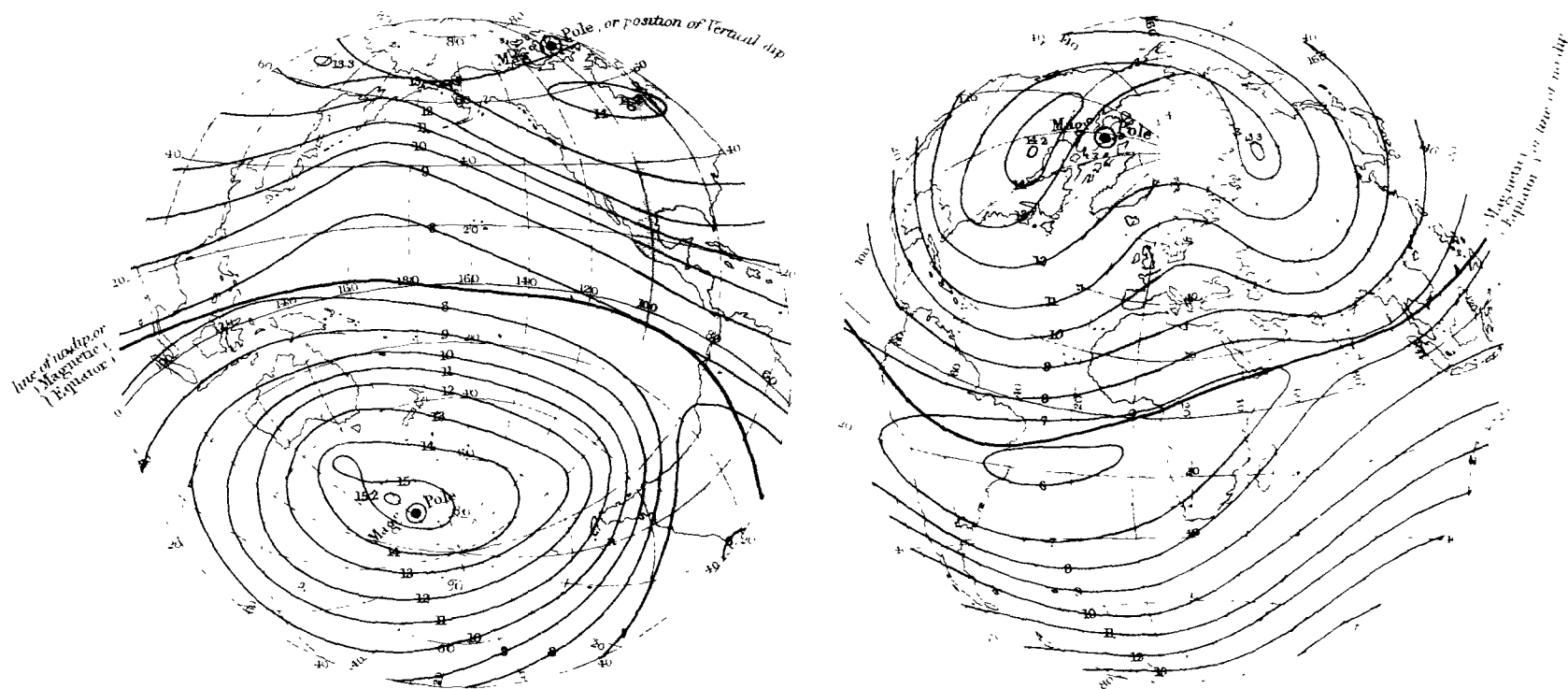


TABLE OF OBSERVATIONS.

STATION.	Date.	Hour.	Tempera- ture Fahr.	Boiling- Point.	Baro- meter.	Altitude.		REMARKS.
						Hypso- meter.	Baro- meter.	
1. Village Ab-i-Garm ..	Aug. 14	10 A.M.	83°·5	199·3	..	7,546	..	The Latitude and Longitude of the Crater are— 35° 57' 20" N. 52° 6' 47" E.
" ..	" "	7.30 A.M.	75°	..	23,100	..	7,475	
2. Siah Vav ..	" "	1·45 P.M.	76°	194·3	..	10,616	..	Altitudes are calculated from Baily's Tables, and corrected for tempera- ture only.
3. Foot of Cone ..	" "	7.30 P.M.	45·5	189·4	..	13,045	..	
" ..	" "	6 P.M.	53°	..	18,720	..	13,203	
4. Banshi Bund ..	" "	8.40 A.M.	38·5	183·4	..	16,593	..	
5. Crater ..	" "	12 A.M.	28·5	179·9	..	18,469	..	
" ..	" "	12 A.M.	..	..	15·260	..	18,493

results, with much accuracy. The party failed, I am informed, in obtaining any reading of the boiling-point. Their observations were made with one instrument, and consequently with an interval of several days.*

I append (p. 217) eight observations, five hypsometric, and three of the barometer. The whole were made between 10 A.M. of the 14th August and 12.30 P.M. of the 15th, and there occurred between those hours no marked atmospheric disturbance.

The ascent from the foot of the cone occupied nine hours, and was attended with little difficulty as far as the fourth station, from which point upwards the atmospheric effects of the altitude are severely felt.

The lowest station, the village of Ab-i-Garm, lies in a glen with an eastern aspect, sheltered by two high spurs. It has several warm mineral springs. The mountain slopes are extensively terraced and cultivated, and the willow, walnut, mulberry, and ash thrive, and attain a considerable girth. The second station marks approximately one line of ramification of the lower features of the mountain. The slopes, those with a northern aspect more especially, are covered with a luxuriant herbage, but entirely destitute of trees. At the third station the ground is covered with greensward, dotted with round tussocks of furze which serve for fuel. The flowering plants are small and inconspicuous. Before the fourth station is reached all sign of vegetation is lost. The volcanic soil of Demavend, which bears a dense herbage while the slopes of the limestone ranges around are nearly bare, appear unsuited to the growth of trees. The dwarf juniper, never absent at the higher altitudes of the Alburz, is represented by a few cultivated specimens. A stunted growth of birch appears curiously enough at one point only, so far as I could observe, at an elevation of 8000 feet, and I have good reason to believe is found nowhere else between, perhaps, the higher levels of the Caucasus and of the Himalaya.

The mountainous country about the peak suggests many curious geological and topographical phenomena, and would well repay exploration.

Believe me, yours truly,
G. NAPIER, Captain R. S. C.

P. S.—I shall be much obliged if you will let me know if any different results should be arrived at from my data.

NOTE by JOHN COLES, Curator of Maps, R.G.S.

April 12, 1878.

In accordance with the wish expressed in Captain Napier's letter, I have carefully calculated (with his data) the height of Mount Demavend.

In order to ensure accuracy, I have calculated his observations by the methods of Regnault and Baily, computing the height from station to station, and also from sea-level to the last observation taken on the summit. The mean of these calculations gives a height above sea-level of 18,848 feet, or 355 feet in excess of the results arrived at by Captain Napier, which may to some extent be accounted for by his having corrected his observations for temperature only.

The statements hitherto made of the height of Mount Demavend are as follows, and range between 14,000 and 21,520 feet. In September 1838, Mr. Taylor Thomson ascended as far as the Sulphur caves (which he erroneously believed to be only a few feet from the summit), and by barometrical measurement

* Their calculation is based on readings on the crater, and at Teheran.

fixed the height of this point at 14,700 feet. Dr. Theodore Kotschy made the ascent of Mount Demavend in 1842, and claims to be the first European who had reached the summit of the Cone. He estimates the height to be 14,000 feet, but took no observations to obtain that result. In 1852, Czarnotta, an Austrian, ascended to the summit, but, owing to unfavourable circumstances, took no observations, and died three weeks afterwards. In 1856, Lieut.-Col. Lemm found the height, by trigonometrical measurement from Teheran, to be 21,120 feet. Mr. R. F. Thomson, Lord Schomberg Kerr, and M. de St. Quentin made the ascent in the summer of 1858 from Rhœna, and ascertained (by barometrical means) its height to be 21,520 feet (see '*Literary Gazette*,' 23rd October, and '*Moniteur Universel*,' 7th December, 1858). Dr. Kotschy, in a letter to Dr. A. Petermann, takes exception to this height, which he considers to be a "vexatious typographical error," stating his opinion that by some mistake 21,000 had been substituted for 12,000, and points to the absence of perpetual snow on cool portions of the summit as evidence in support of his objections to the greater height (see '*Geogr. Mittheil.*' 1859, p. 59).

In 1860 Captain Ivastschenzov, at the head of the Russian Caspian Expedition, by trigonometrical measurements found it to be 18,549 feet. Since 1860, with the exception of the imperfect observations of the Italian Scientific Expedition referred to by Captain Napier, no other observations to determine the height of Mount Demavend have been taken until those of Captain Napier, August the 14th and 15th, 1877.

2. *A Journey in the Interior of New Guinea from Port Moresby.*

By ANDREW GOLDIE.

[Communicated by the Earl of GLASGOW.]

I HAVE the honour to be the first European who has ventured with a small band of men to penetrate by land for a considerable distance into the interior of New Guinea, and, being a British subject, I feel it my duty to lay the result of my journey before the country. My travels may seem nothing when they are compared with the work of other explorers in other countries, but they have the merit of being the first step towards opening up to the world the riches of a vast country; in fact, the only land in the world whose interior has not been explored. I feel confident that New Guinea will not remain much longer in obscurity, and this I state from facts gathered, which I will shortly lay before you.

This is my second visit to New Guinea. I came here last year in the London Missionary Society's vessel, the *Ellangowan*. My object in coming was to collect specimens of natural history, but more especially botanical specimens. I was sent out by a large Nursery firm in London, and am still indebted to them for the means of pursuing my travels.* On my first visit I was six months in New Guinea; I was then forced to leave, owing to bad health. I went back to Sydney, and, after recovering my strength, took a passage in the Torres Straits mail-steamer to Somerset, the port on the Queensland coast which is nearest to New Guinea. I brought down with me seven men—three Europeans and four Kanakas, or South Sea Islanders. I purchased a small lugger, about 12 tons, a good sea-vessel, decked over, and capable of carrying six months' stores. Having no one with me that understood navigation, I entered my men as a crew, and cleared out, as master of

* Mr. B. S. Williams, Upper Holloway, London.

the vessel myself, to a foreign port. The distance we had to travel is several hundreds of miles, and we ran great danger of being shipwrecked, as there are numerous reefs not laid down on the chart. A few extracts from my Journal will not be void of interest.

"*July 4th, 1877.*—Left Somerset on board the lugger *Explorer*, bound to Port Moresby. Reached Murray Island on the 9th of July, sailing only by day, and anchoring under the lee of an island every night. Remained at Murray Island till July 14th, getting things in order for the passage across the gulf. On the 14th we left Murray Island, in company with the mission vessel *Mayri*. All went well that day. We passed through Flinders' passage before dark. After clearing the Portlock reefs, as there was no indication of reefs ahead in the chart, we thought we were safe till we should run down the coast of New Guinea. About twelve that night I was sitting aside the helmsman, when I was startled by the word 'breakers ahead,' from the man on the look-out. The word was given to go about, which was done quickly, and on looking to leeward there was a mass of white foam; one second later in going about, and nothing could have saved us. There is no indication of this reef on the chart; it is close to the main ship-track of vessels bound to China. I gave particulars of the position of the reef in a letter published in Sydney. We sighted the coast of New Guinea on the evening of the second day out. Running in towards the land all night, at daylight we were to the westward of Yule Island, near to the spot where Dr. James, the American naturalist, was murdered last year. We were becalmed for two days; it was only by night we could get to the eastward. At daylight on the third day, after making land, we sighted the mission vessel *Mayri*, 2 miles to windward, under the lee of Lillie Island, the first we saw of her after losing sight of her in the dark our first night out. That same evening we anchored in Port Moresby. A few days after reaching this port, I accompanied two of the Europeans out to the Lalokie River, about 15 miles from Port Moresby, and left them there, collecting specimens of natural history. The camp I knew to be safe, as I had been camped there myself the previous year.

"*July 27th.*—Left Port Moresby in the *Explorer*, and beat up to the eastward opposite Mount Astrolabe; landed with three Kanakas and one European, with the object of ascending the mountain, which is only 10 miles from the coast. Found several hundreds of natives on the beach, all armed with spears, but showing a friendly spirit. About fifty of them accompanied us inland, carrying our stores. We could not induce them to go farther than about 8 miles, as they were in great terror of the inland tribes. We camped near the foot of the mountain, near a mountain-stream. I got knocked up with sore feet, and therefore found it impossible myself to ascend the mountain. But I sent Shaw and a Kanaka with instructions to reach the summit if possible, which they succeeded in doing, after great toil. They reported the top of the range to be not wider than a few feet, with perpendicular cliffs of over 1000 feet. They could only reach the summit by climbing up trees and vines at great risk, and were unable to bring back with them any specimens of natural history except a small orchid.

"Two of my men observed several hundreds of natives two miles nearer the coast than our camp, all armed and painted, I have no doubt discussing whether they should attack us or not. I have no doubt they thought it safer not to do so, as we were well armed, and slept with our belts and cartridge-pouches on, ready for any emergency. We were the first Europeans that had gone inland in this direction. Our safety lay simply in the fact that Europeans had never harmed or done anything wrong to the coast-tribes; the Rev. Mr. Lawes being the only European that had ever visited even the coast-tribes, and his name at present acting as a pass-word of safety to other

Europeans, as belonging to the same race as the good man, the man that makes peace. We remained here a few days only, as the place offered no inducements for a naturalist.

"*Friday, August 10th.*—We ran down to the westward as far as Redscar Bay, and then ran up the bay and anchored. Landing in the dingy, we found the country nothing but mangrove-swamps. Weighed anchor that same night and stood out to sea, as I thought it not right to risk the health of the men in a swampy country. The next day we beat to windward as far as Boaro, where the London Missionary Society has a teacher placed, who kindly assisted me very much in my work. We engaged natives to carry our stores, and went inland 15 miles in the direction of Usboine River. The track explored I have marked on my chart, a tracing of which I send with this letter.* The country in this direction was poor, dry, and stony, but densely covered with natural grasses—splendid feed for horse and cattle. We camped at a large lagoon abounding in water-birds. I collected nearly one hundred birds' skins here. We would have advanced still further in our researches here, but, unfortunately, Shaw shot off the first joint of his thumb; so I deemed it prudent to return to Port Moresby to consult the Rev. Mr. Lawes as to the treatment of the wound, which I am glad to state has entirely healed.

"*Monday, August 27th.*—Started at daylight, accompanied by the Rev. Mr. Lawes, to pay a visit to a village situated about 30 miles inland from Port Moresby, the position of which I have marked on the accompanying tracing. We had nine natives of Port Moresby with us, Rua, one of the teachers, and three of my black boys. The first 20 miles were easy travelling, as the country was comparatively flat, densely covered with natural grasses, and provided with an abundance of good water. The last 10 miles was a toilsome march, continually ascending steep hills: it proved a wild, barren country, the slopes of the hills densely covered with bush; the ridges narrow. It is on the top of these wild mountains that the natives build their houses. At a former visit to the same district, I slept in a deserted house; it had a roof, but the sides had now disappeared. There were two of the missionaries with me, and I was fortunate in having my hammock swung in the centre of the house, with a reverend gentleman on each side. The prospect was pleasant enough as long as they lay looking towards me; but when either of them looked out from the building they saw they were hanging over a precipice at least 500 feet high, sloping at an angle of about 90°. The position was so unpleasant that they preferred leaving their hammocks and spending the night on the floor under my resting-place. The natives here often sleep in the bush at night, giving as the reason that if an unfriendly tribe should come to attack them they would be easily found in the houses, but safe in the bush. They likewise build a great many of their houses up trees at least 60 feet high, and these trees growing on the top of steep hills such as I have described. I can sum up the country in this direction as nothing but wild hills so steep that it is difficult to ascend them, densely covered with bush, with mountain-streams running at their base; rugged, grand, and wild scenery.

"The next three months my time was mostly taken up with collecting specimens of natural history; in that time we collected nearly 1000 birds' skins. In the collection there are 124 distinct species of birds. I was fortunate to get 23 specimens of *Paradisea raggiana*, a bird of paradise of great beauty, discovered by an Italian naturalist. Twice our lives have been in great danger. Inland tribes both times made a midnight attack on us;

* The rivers explored by Mr. Goldie have been added to the Admiralty chart of this part of New Guinea; the original tracings are deposited in the Map-Room of the Society.—Ed.

our lives each time being saved by a valuable dog that gave us timely warning. They were close up to our tent when we were roused by the furious barking of the dog. The second time one of my black boys was nearly made a prisoner; he saved himself only by plunging into the river. My attention in the early part of November was suddenly attracted to the discovery of gold, by one of my black boys bringing to me a piece of quartz with gold and mundic in it. On the 15th of November we started from our camp, which was situated 20 miles from Port Moresby. To get to this point even we required the assistance of two tribes of natives. All my inducements failed in getting the second tribe to go further than another 6 miles; they were in great terror of natives still further inland, and warned us to sleep with one eye open. At this point, about 25 miles from Port Moresby, we were thrown entirely on our own resources. My inland party was composed of myself and another European, Mr. Morten, a most willing and energetic assistant, and three black boys, each from different islands in the South Seas. We had more stores than eight men could easily carry; to get rid of the surplus we dug a hole in the sand, and took with us only what we could conveniently carry. We were determined to follow the course of the river where we found the first prospect of gold, as long as our provisions would last. We had to ford the river, often at some point extremely dangerous, but the word 'onward' was our motto.

"*Tuesday, Nov. 10th.*—We started at daylight, following the course of the river, which was very circuitous; it was a toilsome march, as the black boys were heavily loaded. On the way we passed through a native village; there were no natives about, the doors were all closed, but it had every appearance of being lately inhabited. We went up a hill about 1000 feet high, which gave us a fine view of the country. The river was twice crossed, once with great difficulty, as the current was very rapid.

"*Friday, Nov. 17th.*—We moved our camp a short distance up the river; spent a day prospecting the light drift on the banks of the river. We found gold in the black sand at every prospect, and the bed of the river scattered with quartz, bearing gold and mundic, samples of which I have forwarded to Sydney. While taking lunch, three natives were observed closely following our track. They were keeping their eyes closely fixed on the ground, in the exact track we had come, but they proved friendly, and fearlessly crossed the river to us, leaving their spears behind. They went up the river with three of my men as guides, and drew the attention of my men to the tracks of a wild animal in the bush, showing great terror of it. This is the first indication of a large land animal being found in New Guinea. I have seen the tracks. What kind of animal it is, I cannot explain; but there is not the slightest doubt in my mind, and in the minds of all my party, that such a creature exists here. The tracks had the appearance of horse-hoofs, with shoes on quite as large, but with this difference, there was the impression of four toes. We know well the footprints of the crocodile, and they do not in the slightest resemble them; it must be a heavy animal, as we saw the impression where it had been lying in the sand, and the natives informed us it lived in the bush, not in the river. I caught to-day an immense beetle, measuring 6 inches long, and covered all over with sharp spines: it is a Longicorn species. If new, it will be interesting to the lovers of these beautiful insects.

"*Saturday, Nov. 18th.*—We passed through a fine tract of country, undulating, not the wild mountain-ridges I had seen in my previous journey. Inland there is good productive land, fit to grow any tropical produce. To-day we reckon our distance from Port Moresby, in a straight line, to be 40 miles; and we have passed through a splendid grassy country, all densely covered with natural grasses, making good feed for horse and cattle, and there was abundance

of good water and very few natives. The native population on this part of New Guinea is numerous on the coast; but inland the island is thinly populated. We came upon a small party of natives going inland; I easily induced them to relieve the men of their burdens. At this point the country changed entirely; instead of open grassy land it became dense bush, intermixed with numerous climbers, the timber very light, and the banks of the river very steep, which made travelling very difficult.

"*Monday, Nov. 20th.*—Buried all but one day's supply of stores, as we saw it would be impossible to proceed further than about another 10 miles, for want of having sufficient food; we could add very little to our stores, as game here became very scarce. Kangaroo we lose whenever we leave the open country. To-day we cut down a palm-tree, and eat the crown of it; it made us all sick. At this point I suddenly came upon a clump of beautiful fern-trees, with stems 20 feet high; they resembled *Aloesphyllum Youngii*, the stem hairy, but not so dark as that variety, trunk about 6 inches in diameter. The last 10 miles proved very hard travelling, so we most reluctantly returned. Before doing so we got a fine view of the country. I think if we could have continued a day's journey further, we should have come upon an open flat country. I have taken the bearings and distances of my route, and placed the latter on the chart, a tracing of which I forward with this letter. We have passed through four tribes of natives, who are all in terror of one another. I have named the river Goldie River; it is a tributary of the Usborne that runs into Redscar Bay. I consider since I arrived here I have travelled in different directions not less than 400 miles: all the geographical discoveries made I have correctly put down on my chart; also the nature of the land, native products, and native customs. I am engaged in collecting specimens of natural history in all its branches; likewise native implements and curiosities. I leave Port Moresby in about two weeks for a four months' cruise to the eastward, calling at all the places where we can conveniently land without endangering our lives. My object in this cruise is more especially to collect living botanical specimens. We intend, if God spares us, to be back in Port Moresby in the month of May. Thence bound to Somerset, and may God grant the same measure of success and health as we enjoy at present."

3. *Notes on Daka and Pandamatinka, on the Zambesi.*

By R. FREWEN, Esq.

[Communicated by His Excellency Sir BARTLE FREERE, Bart., Governor of Cape Colony.]

THE following are extracts from two letters, dated Wankie, August 29th, and Daka, Sept. 21st, 1877, addressed to the Under-Colonial Secretary, Cape Town:—

Mr. Frewen says that after three months' hard work he reached Daka, and from there went to Pandamatinka, "which is the most northern trading station of South Africa, and belongs to the most considerable trader on the Zambesi." Mr. Westbeach is his name, fourteen years living in that country, and apparently a man of very great influence with the chiefs, both cis- and trans-Zambesi.

Mr. Frewen is delighted with the Victoria Falls, and gives some details with reference to them. He finds the place he writes from, Wankie, 80 miles below the Falls, to be 1564 feet above the sea. The altitude at the Falls he finds to be 2900 feet above the sea. Hence, in 80 miles, *i.e.* from the Falls

to Wankie, the river falls 1336 feet, or nearly as much as the whole fall from Wankie to the sea.

The Portuguese, he states, come up to Wankie from Zumbo and Tete, to buy slaves to exchange for ivory. They come in boats to within 100 miles of Wankie, where there are rapids, and then make the journey overland.

Mr. Frewen intends awaiting the dry season, *i.e.* April 1878, and feels confident of being then able to push on across the Zambesi to Lake Bangweolo, where Dr. Livingstone died; thus spanning the as yet unconnected link between the Cape of Good Hope and the Mediterranean Sea.

4. *Remarks on the Line of Inland Telegraph suggested in the African Exploration Committee's Circular.* By ST. VINCENT ERSKINE.

[Communicated by His Excellency Sir BARTLE FREERE, Bart., Governor of Cape Colony.]

Kokstad, East Griqua Land, Dec. 31, 1877.

I HAVE to thank you for the memoranda of the Exploration Committee of the Royal Geographical Society, and enclosures sent by Mr. Henkel.

I would like to say a few words on the contemplated or suggested inland Telegraph through Africa. This is a matter that has been often discussed, and few or none acquainted with the country to the north of the British settlements, and the natives there, consider it impracticable.

The question resolves itself into a consideration of route. Whether to follow the interior of the continent or the sea-coast.

I should abandon any consideration of the coast-route, as it would be impossible to deal with the natives surrounding the Portuguese towns (I purposely avoid the word settlement, as there are no such things) on the coast north of Delagoa Bay.

In the interior, where the natives know white men through their dealings with Englishmen, English influence is felt and trusted, as well as their trade appreciated.

For the sake of brevity dismissing the country south of the northern border of the Transvaal, the Limpopo, which presents no obstacles, and also that north of Gondokoro,* already spanned by the wire, the distance intervening is only about twenty-two degrees of latitude, or about 1300 geographical miles. The first country to be crossed after the Transvaal would be that under Nobengule Matskoban (commonly known as Umzilagasi or Matabele). This Nobengule is a civilised Kaffir, wearing clothes and boots, sits at a table, and so on, and is fond of white men.

He not only would not object to the telegraph, but would render every assistance, and for a small subsidy would command his people to cut poles and transport material for nothing, more especially if it were a Government undertaking. His dominions extend from the frontier of the Transvaal on the south to the Zambesi on the north. Here, then, the Portuguese at Zumbo would be found. Beyond this I know nothing excepting from hearsay. The Portuguese, though, have often told me that they find no difficulty with the aborigines, but are sometimes plundered by marauding Maretshas (Zulus); but as these people only seek booty, they would not wantonly destroy the telegraph. But they could be sought in their own country, and, by judicious

* The wire does not extend to Gondokoro: it has only reached Khartum.—[J. A. GRANT.]

subsidising, actually converted into preservers of it; as the minor tribes could be frightened into preserving the telegraph intact, if threatened with descent of these newly-converted "police." North of that again we arrive at Lake Bangweolo, amongst Livingstone's friends, who do not seem at all difficult to deal with; and thence, working through Arab influence, almost up to Albert Nyanza. In fact, the only *terra incognita* is just north of Nyangwe and the Lualaba: even here they must have heard of Englishmen and felt a desire to see them. I suppose stations would have to be erected at every hundred miles or so, and also at important points of branch communications with Delagoa Bay, Quillimane, Mozambique, Zanzibar, &c. Of course, the missionary settlements and other points forming a nucleus of white settlements, would have to stand on the line of route. These are mere matters of detail.

I now approach the main subject—

The Exploration of the Route.—I think this a favourable time to move in the matter, when Governments and people are so intent on African exploration.

The Colonial Government at this end might step forward, and by subsidising one of the contemplated routes of the African Exploration Committee so divert its contemplated course as to secure its services in the exploration of a telegraphic route.

The Committee could also, when relieved of some part of the expense at this end, so devote the saving as to divert some of their northern journeys to connect the route through to Gondokoro; thus assisting all parties and serving an immediately practical and useful end, without sacrificing the requirements of Geographical science.

I believe at least one of your Ministers—the Honourable the Commissioner for Crown Lands and Public Works—is convinced of its entire practicability.

As the advantage would be even more Imperial than Colonial, your Excellency, as High Commissioner, is no doubt in a position to see the matter from both standpoints.

I presume to write on this subject from the experience of the Portuguese and the adjacent independent Kaffirs, in the southern portion of the province of Mozambique and the interior, which five years' travel among them has given me.

ST. VINCENT ERSKINE.

5. *Report of a Reconnaissance of Lake Albert, made by order of His Excellency General Gordon Pacha, Governor-General of the Soudan, By Colonel MASON-BEY.*

Khartum, 29th August, 1877.

EXCELLENCY:—I have the honour to report my return from Lake Albert-Nyanza, and to submit the following Report, with the accompanying maps, papers, &c., as the results of observations.

Leaving Magungo on the 14th of June, with the steamer *Nyanza*, we returned on the 19th, having made a careful reconnaissance of the entire shores of the Lake.

In all we were fifty-two hours under steam, during which time I examined every inlet or indentation of the coast-line.

Following down the western shore, I found it overhung by lofty and almost precipitous mountains, notwithstanding which there

seemed to be a large population. Wherever the configuration of the mountains permitted, or ravines had formed a flat point, there would be quite a large village; but in general the natives lived behind the cliffs, in small valleys, the only signs of their presence being their boats on the beach, and the smoke curling up from the valleys.

At sunset on the 14th, we anchored under the shelter of a flat point, on which was quite a large village, surrounded by plantations of bananas. I was agreeably surprised to find the chief, Hakikie by name, come off to us, bringing a large sheep as an offering. He gave us as the name of the village, *Nursuar*.

His principal reason for coming off was to induce us to assist him in making an attack on some villages a short distance to the north, which he represented as very rich in cattle. This I declined, advising him to keep the peace. This chief wore yellow metal bracelets, which he had received from Aufina's people. He protested that they had no ivory.

The following day we continued our route to the south-west, skirting along the mountains; after six hours' run, the coast-line trends more to the south, forming a wide plain, in some places covered with very heavy, thick forests. The shores had now become very low. At 3 P.M. we reached a wide bay; here I came to anchor, for the purpose of examining the country, cutting wood, and observing the latitude. The following morning we crossed the bay, and made fast to the beach, where we took in a supply of wood. We were visited by some of the natives, who gave us as the name of the place, *Kavalee*. They informed me that we were near the end of the Lake; that they could cross to the mountains on the other side in three days. They said that they could not get through the *Ambatch* to the southern shore of the Lake, as it was deep marsh; but that beyond the marsh there were many villages and people. Leaving *Kavalee* soon after noon, I found that we soon turned to the eastward. After two hours' run, we were close in with the *Ambatch*. The southern end of the Lake is very shallow, and there is much grass. In the south-west corner of the Lake I noticed a second large bay; and from a depression in the mountains, and a thick line of forest, fancied that there might be a river emptying into the Lake at that point. I could find no entrance. This accorded with what the natives told me at *Kavalee*, that there is no river joining the Lake near there.

Continuing our route until sunset, we anchored among the *Ambatch*, and were soon enveloped in clouds of mosquitoes, which seemed to be twice as numerous there as on other parts of the

Nile. The following morning, after entering a number of small bights, from which I was forced to retire owing to the shallowness of the water, I finally entered a broad river, the waters of which were reddish in colour, with a slight northerly current. There was no floating vegetation, only a little dried matter, bits of straw or wood, floating on end, as if water-logged.

The width of this stream is about 400 yards; the banks high and well defined, clothed with forests. I was only able to proceed one hour, after which I constantly got aground.

There seemed to be a mass of vegetation blocking the way to the south, or up the stream. To the south-east I observed an immense forest of date-palms. To the south and south-west, an undulating country, clothed with large trees.

After leaving this river, I found that we had crossed the Lake, and that our course turned to the northward. On both sides of the Lake the mountains diminish in altitude; and to the southward, at the foot of the Lake, and between the two ranges, was a large isolated mountain; the meridian altitude of the sun gave me for the latitude $1^{\circ} 11' N$. We were then in the south-eastern corner of the Lake. Thus it does not extend to the first parallel of north latitude. Going to the northward, the mountains are not so high as on the western shore; and only in one place are the cliffs of about the same height as the highest of the western ones. There is a marked difference in the vegetation: to the west, the mountains are well covered with timber and verdure; in many places the natives have cleared places for cultivation: on the east, the mountains are barren, with neither timber nor vegetation. While going southward, the eastern shore was visible; while going northward, the western shore was more plainly visible. As we approached the villages on this side, the people invariably fled at the sight of the steamer.

Near the south-east corner I noticed a small cascade, that the *MTongoli* said comes from a stream called *Katooka*.

The following day we passed several large villages, one of which was said to be the residence of *Kava-Gonza*, brother to *Kava-Rega*. Soon after, we passed the village of *Tiabo*; here I remained for an hour, persuaded the people not to run off, but to remain and bring me some wood, which they did, bringing it off in their canoes.

To the north of *Tiabo*, the country is flat: the coast-line trending to the north. With that part of the country your Excellency is acquainted.

The value of the track of the steamer, as laid down, is dependent on the accuracy of the observations for azimuth, taken in the bay

at Kavalee, to ascertain the deviation of the steamer's compass. The other positions are independent. At Kavalee I also determined the difference of longitude from Magungo, which agreed very well with the departure. The measure of value was the difference of latitude, as observed; the courses were kept in minutes of time, and the azimuths reduced therefrom.

The distance of each course was determined by the coefficient arising from the number of minutes of time and the miles of latitude made between certain observations—as the measure of the steamer's speed.

The longitude of Magungo was determined by the mean of four observations of the eclipses of the satellites of Jupiter. The latitude by the mean of a large number of meridian altitudes of stars, north and south of the zenith.

The latitudes of other points on the Lake from meridian altitudes of the sun; at Kavalee on the artificial horizon, at the other places on the sea horizon.

The latitudes of all other places, mean results, as at Magungo. The difference of longitude of Kavalee, by means of a watch that kept a very uniform rate, and which was treated as a chronometer. The difference of longitude for Duffli, Labore, Kirrie and Lado were carried on by the same means, the results agreeing with the difference by the azimuths.

The annexed sheet (p. 229) contains the *resumé* of the astronomical observations.

I have the honour to be,

Your Excellency's most obedient Servant,

(Signed)

A. M. MASON,

Colonel Staff Corps.

To His Excellency GORDON PACHA,

Governor-General of the Soudan.

NOTE.—Sir Samuel Baker, in a letter to the President, calls in question the accuracy of Colonel Mason-Bey's determination of the latitude of the S.W. and S.E. corners of the Lake. According to Sir Samuel's own observation from the heights at Vacovia, and his calculation of the number of hours' steaming of Colonel Mason-Bey, the southern end of the Lake would lie much further south than $1^{\circ} 11'$ and $1^{\circ} 22' N$. The observations on which these positions are founded, are meridian altitudes of the sun: but Sir Samuel states that observations of meridian altitude of stars would have given a different result; in corroboration of which view he points out that where Colonel Mason-Bey determines a position by such observations, as at Magungo, his latitude agrees with that ascertained by himself by means of the same class of observations.

**RESULTS OF ASTRONOMICAL OBSERVATIONS. EQUATORIAL PROVINCES,
1877.**

	Latitude North.			Longitude E. of Greenwich.			Mag. Var. Westerly.	
	°	'	"	°	'	"	°	
Lado	5	01	33	31	49	36	..	The latitude from a mean of 6 merid. alts. of stars north of the zenith and 6 south. Longitude referred to Magungo.
Beddene ..	4	35	48	31	36	06	9 34	Mean of 3 merid. alts. of stars north and 1 south of zenith. Longitude referred to Lado by azimuth. Mag. var. obs. for amplitude and for azimuth.
Kirrie	4	18	10	31	40	28	..	Latitude mean 5 merid. alts. of stars north and 5 south of zenith. Longitude referred to Magungo.
Laboré	3	55	42	31	51	24	11 15	Latitude mean of 6 merid. alts. of stars north and 6 south of zenith. Longitude referred to Magungo. Mag. var. from obs. for amplitude and azimuth.
Duffli	3	34	55	32	02	45	7 15	Latitude mean of 4 merid. alts. of stars north and 5 south of zenith. Longitude referred to Magungo. Mag. var. from obs. for amplitude and azimuth.
Magungo ..	2	14	42	31	31	45	8 23	Latitude mean of 12 merid. alts. of stars north and 12 south of zenith. Longitude mean of 4 obs. of eclipses of satellites of Jupiter. Mag. var. obs. for amplitude and for azimuth.
Kavalee, S.W. angle of Lake Albert.	1	22	20	30	31	23	..	Latitude merid. alt. of sun. Artificial horizon. Longitude A.M. Obs. referred to Magungo.
S.E. angle of Lake Albert.	1	11	03	..	..	..	..	Latitude meridian alt. of sun on sea-horizon.

PROCEEDINGS
OF
THE ROYAL GEOGRAPHICAL SOCIETY.

[PUBLISHED JULY 6TH, 1878.]

SESSION 1877-8.

Ninth Meeting, 25th March, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*George T. Wickenden, Esq.*

ELECTIONS.—*George William Campbell, Esq. ; James Campbell, Esq. ; Alfred Hicks, Esq. ; Henry Page, Esq. ; Capt. Temple Leighton Phipson-Wybrants ; Lieut. Henry P. Routh, R.N.*

DONATIONS TO THE LIBRARY FROM THE 11TH TO THE 25TH MARCH.
—Le Royaume de Siam, par A. Gréhan, 1869 (*Author, Consul to King of Siam at Paris*). Reference Catalogue of current literature, 1877 (*Messrs. Sotheran and Co.*). Notes on the parallel roads of Lochaber, by Sir Henry James, 1874 (*The Ordnance Survey*). Hakluyt Society publication, No. lvi., The Voyages of Sir James Lancaster to the East Indies, &c., by Clements R. Markham, 1877 (*The Hakluyt Society*). Report of the U. States Geological Survey of the Territories, vol. vii., being pt. 2 of Contributions to the Fossil Flora of the Western Territories, the Tertiary Flora, by Leo Lesquereux; and Miscellaneous publications, No. 9, Descriptive Catalogue of photographs of North American Indians, by W. H. Jackson (*Dr. F. V. Hayden*). Report of the Geological Exploration of the 40th Parallel, by Clarence King, vol. ii.; Descriptive Geology, by A. Hague and S. F. Emmons (*Clarence King, Esq.*). Tableau géographique de la distribution ethnographique des nations et des langues en Mexique, 1878, and l'Expédition polaire Anglaise en

1875, par V. A. Malte-Brun, 1876 (*Author*). Marine Survey Department, Calcutta: List of light-houses, &c., in British India, to 1st January, 1878, by R. C. Carrington (*Author*). Découverte des grands lacs de l'Afrique Centrale et des sources du Nil et du Zaïre du 16^me siècle, par T. Brucker. Lyons, 1878 (*Author*). Statistical Register of Victoria for 1876, Part 7 (*The Victorian Government*). Études de la Géographie Botanique de l'Italie, par P. Parlatore; Paris, 1878 (*M. de Tchihatcheff*). Further Correspondence respecting the affairs of South Africa, 1878 (*Lord Arthur Russell*). Jahresbericht der Commission zur wissenschaftlichen Untersuchung der Deutschen Meere in Kiel, 1874-1876 (*The Commission*). The languages and races of Dardistan, by G. W. Leitner: Lahore, 1877 (*Lepel Griffin, Esq., Officiating Secretary of Government, Punjab*). Mont Blanc and the Valley of Chamonix. On the Zambesi, by J. Stewart (from 'Good Words'), and Alex. von Humboldt, Festrede von A. Bastian, 1869 (*S. M. Drach, Esq.*). And the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM MARCH 11TH TO MARCH 25TH, 1878.—Admiralty Charts, 9 sheets (*The Hydrographer*). United States Charts, 1 sheet (*Commodore R. H. Wyman*). Ordnance Survey Maps, 362 sheets, and area books (*The Director-General of the Ordnance Survey*). Carte du Royaume de Siam (*M. A. Gréhan*). Geological Survey of Sweden, 7 sheets (*Bureau Géologique de la Suède*). Map of Queensland (*Queensland Government*). Le Lac de Genève, par E. Pictet (*Professor Paul Chaux*).

The PRESIDENT said, the first Paper of the evening would be one by Mr. Cotterill, who had within the past few days returned from an eventful exploration of the region between the north end of Lake Nyassa and the East Coast, *via* Ugogo. Consul Elton, who started with him and led the party, had died of sunstroke before the journey was completed. In him the public had lost a valuable official, and the Royal Geographical Society a most intrepid explorer.

The second Paper would be by Mr. Haidan, on a proposed railway adapted for such a wild country as Africa. It required no embankments, sleepers, or any of the ordinary conditions of a European railroad. No doubt the Paper would elicit valuable discussion as to the best means of getting over the difficulties connected with the employment of pagazi, who so often threw down their burdens, and left the unhappy traveller without either the means of feeding himself or of getting forward.

Mr. Cotterill's name was very well known. Some two or three years ago he embarked for Central Africa, with a view to ascertain whether it would not be possible to sow some germs of a legitimate trade there, as one means of civilising the country, and checking, if not suppressing, the slave-trade. By his old masters and schoolfellows at Harrow he was supplied with a steel boat, and in that boat he had navigated Lake Nyassa, and his explorations in that region were full of interest.

1.—*On the Nyassa and a Journey from the North End to Zanzibar.*

By H. B. COTTERILL.

ALTHOUGH the latter part of my subject this evening—viz. the journey through the hitherto unvisited regions north of the Lake—is naturally that of which I wish to speak principally, I must first give a preliminary sketch of circumstances that paved the way towards this journey. First, let me state the motive that induced me to visit Nyassa. In common with many other Englishmen and Englishwomen, I had read with horror the descriptions given by Dr. Livingstone of that terrible scourge of Africa—the slave-trade; and, to make a short story of it, made up my mind to follow out his idea of attempting to plant in Central Africa a germ of legitimate trade, which might in time serve as an antidote to the illegal trade in men. The first thing to be done was evidently to “prospect” the country, and, with the help of many kind friends, I was able to furnish myself with a small stock of goods with which to make the experiment. Of course, the great expenses connected with a first attempt of this nature precluded all idea of a mercantile success, so that the liberality with which my venture was encouraged was all the more conspicuous. In addition to these goods, a most acceptable present was made to me by my friends at Harrow School—namely, a steel boat, built in compartments, 30 feet in length. The *Harya*, as she was christened, is cutter-rigged, and can be manned with ten oars. She was built by Messrs. Yarrow.

I sailed from England in May 1876, together with a party of Scotch missionaries, who were bound for Livingstonia. We were joined at the Cape by Dr. Stewart, and, after a long delay, arrived at Quillimane in a chartered steamer, the *Ansgarins*. It was already late in the season, and the water in the Quillimane River (the Kwakwa) was at low ebb; so that, after being delayed amongst the mangrove-swamps of the Portuguese town for seventeen days, on account of difficulties with the custom-house officials, we had a long wearisome pull up the stream, having finally to empty our larger boats of all cargo and rigging, and drag them over innumerable mud-banks before we reached Karrokwe, where the Kwakwa approaches within some 3 or 4 miles of Mazaro. Here it was necessary to take my boat to pieces, and she was successfully transported (though not without many strikes on the part of the natives), and launched on the waters of the Zambesi. Mr. Henderson, one of the “Livingstonia” party, met us here. He had been awaiting our arrival at the Kongone for some weeks, having brought down two wooden boats from below the cataracts.

The journey up the rivers has probably been described more than once before in this room, so I shall do no more than say that, after visiting Shupanga, where Mrs. Livingstone lies buried, we crept slowly up against the strong current of the Shiré, through the terrible mud-banks and mosquitoes of the Morambala and Elephant Marsh, where I saw my first elephants marching in a long line, their stately forms standing out grandly against the red of an African sunset. The banks of the river are in parts thronged with game, of which we got our full share, and its waters are tenanted by great numbers of hippopotami and crocodiles. We had some encounters with the former—one of the party, who was travelling in a native canoe, being driven ashore by one of these monsters, and obliged to spend a miserable night on a small mud-bank. At Malo, where the River Ruo from near Lake Shirwa joins the Shiré, we found another of those “milestones of Christianity” (too common, alas! on this river), the grave of Bishop Mackenzie. These graves are carefully tended by the natives, and I trust they will, in times to come, still exist as memorials of the noble-hearted men who gave their lives for Africa.

Shortly before arriving at the foot of the cataracts near Chibisa's, the old station of the Universities' Mission, we were met by Mr. E. D. Young. With his well-known vigour, he had collected some hundreds of carriers for us, and soon started with a large caravan for Mpimbi above the cataracts. After a delay of several days at Matiti, during which the natives obstinately refused to tackle the *Herga's* large compartments, I at last slung them on long poles, and by offers of extra pay (it only amounted after all to 3 fathoms, *i.e.* 3s. each for 55 miles), crossed the rough cataract country. Fortunately I was able to supply my 150 carriers with plenty of what they so dearly love—“enyama”—meat; for game was very plentiful. They carried with a will, and brought everything safe and sound to Mpimbi, without the loss of a single screw or nut.

It was a tough bit of work, and galled the skin off their shoulders terribly, but they seemed as delighted as I was myself to see the beautiful *Herga*, with her dark-blue flag at the mast-head, floating on the waters of the Upper Shiré, whence it was but a few days' sail to the great Lake. Mr. Young had meantime taken his little steam-launch, the *Ilala*, up to Livingstonia, deeply laden with goods, and soon returned to escort us onwards. At first the *Ilala*, in true sisterly fashion, took the *Herga* in tow, but on Lake Panalombe we were cast off and soon outdistanced the steamer. I paid a short visit to Mponda, the wily old chief at the outlet of the Shiré, whom I found full of false assertions of his friendship and

his innocence in the matter of the slave-trade—how false will be proved ere long. Then, flying her Harrow ensign, and streamers representing Brighton, Haileybury, and Fettes College (for all these schools had helped to launch her on Nyassa), the *Herga* proudly cut her way through the dark-blue waves of the open Lake, and ran up towards Cape Maclear. Never shall I forget the wonderful beauty and grandeur of the scene that was then first spread before my eyes—that vast expanse of blue transparent water bounded by lofty ranges of mountains, fringed with yellow sands and granite rocks, while every here and there a cluster of native huts lay nestling amid the richly-coloured woods.

As I reached the Cape, night fell, and the wind rose. Had I then known what Nyassa was, I might have been more anxious, as the waves came sweeping up and bursting with a roar on the rocky point. Soon, however, the *Ilala* came up: the cheery voice of Mr. Young hailed us through the darkness, and we were towed safely into the sheltered harbour of Livingstonia. I cannot here attempt to depict the beauty of this spot—where I spent the months of the rainy season, occasionally making short excursions to the neighbouring villages, and amusing myself chiefly with shooting and fishing, of which there was an abundance. One thing especially struck me (though second in loveliness to the Lake itself), and that was the excessive richness and beautiful shades of colour in the woods and forests that clothe the hills of Cape Maclear—and this was all the more striking to one whose ideas of Africa were formed, when a boy, at the Cape, where the stumpy mimosa-bush is painfully omnipresent.

I began a little trade with Mponda, but after one or two purchases from him, and an attempt to deal with Makanjira, on the east coast of Nyassa, I found that the Arab influence was too strong for me, and decided to visit other parts where the slavers were not in such force.

About the end of February I made a fortnight's excursion to Tambala's, whose village was reported to lie about three days inland from the opposite shore of the Lake. I will read here a few extracts from a diary, which escaped the fate that befell the others one stormy night, as is to be related hereafter.

"*Wednesday, February 28.*—Started with three canoes, taking S. and my four men. Reached Chiuambo's, and engaged another canoe and eight bearers. As I was waiting for food, a gang of some thirty or forty slaves with two or three armed drivers passed by. There were several women and small children among them. I could have easily overpowered the slavers and liberated the whole gang, and I actually took my revolver and stepped forward to do so; but, great as the temptation was, I was cold-blooded enough to allow my

judgment to prevail, lest the result should lead to more evil than such an act could remove. My conscience reproaches me now; I cannot tell whether I acted wisely in restraining myself. Poor creatures! I trust I shall not be to blame for their future miseries. One poor fellow was a mere skeleton, with bad hip-disease; he could scarcely totter along, and can never reach his destination. They were from Chipeta's, and bound for Mponda's. We now see the real character of this double villain. The people at Chirombo's report many gangs by this route. Famine is reported at Chipeta's in consequence of wars. This chief is selling his people for salt—a plateful for a victim.

"*Thursday, March 1.*—Passed the curious dome-shaped hill of Marenge. His village (mentioned by Livingstone as very large) is now deserted; he was murdered by Pemba seven years ago. Coasted along the great marsh or 'sponge' described by Livingstone. This is where Musa deserted Livingstone and brought back false news of his death. Met canoes returning with some of Mponda's men, who were behind the main body, and had turned back for fear of Maviti. Some natives were sent last year from our settlement to buy goats at Tambala's, and were robbed of ten pieces of cloth by these marauders. Huge masses of reeds, twenty feet high, and papyrus, evidently the source of many floating islands. A hippopotamus plunged in close to my boat: passed large schools of them; very tame; wounded one severely, but could not stop. Fearful landing-place. Boatmen want to sleep here, and say we shall have to sleep in canoes if we go on; but I insist on their pushing forward. We make for a spot where a palm and some trees seem to indicate dry ground, and forcing a way through the reeds, reach it and encamp; a mere wallowing ground for hippopotami about thirty yards in diameter. They keep me awake, and come near my tent.

"*Friday, 2.*—Start 5 p.m.: very calm—slight north wind generally springs up at midday. This is indeed a *γλυκὺς ἀγών*. Arrive at landing-place about 1 p.m.; encamp. I go out with my gun, and come across skeleton of elephant and one tusk weighing 80 lb.; the other had been gnawn to pieces by wild beasts.

"*Saturday, 3.*—Sent two men with axe for teeth of elephant; they return with story of a lion which had killed a buffalo near the spot, and had prevented them from obtaining the teeth. Wishing to push on, and doubting their story, I made an early start. Strike towards s.w., pass the tree under which the 'Doctor inkuru' (great doctor, *i.e.* Livingstone) is said to have encamped. Men stop to take honey: a great amount of dark comb, but good eating; fearful grass and swamp—no path except elephant-track. Reach the hills, and ascend valley of Mpakwe—deep ravine, full of long grass, reeds, and creepers. Encamp 700 feet above lake. Men gather green caterpillars for food. Scenery lovely. Water of streams bluish-white (from kaolin). One bearer sick, pimples all over, and severe rheumatic pains—the natives call it 'chikuku.' By dividing his load, some of the men must have had at least 70 lb. to carry; and it is wonderful how they go across this fearful country with such weights.

"*Sunday, 4.*—Forced to push on, for I gave the canoes six days to return, and we shall take more. A very tiring ascent. Magnificent view of both arms of the Lake. Cross the range 3000 feet above lake (4500 above sea). Air most refreshing. Vegetation like Cape, many proteas, everlasting, &c., and groves of a large dark tree like yellow wood. To the s.w. a grand panorama. One great range (Nzoma), running e. and w. on the other side of this hilly plateau, which is about 20 miles broad and 2000 feet above lake. Rain at night.

"*Monday, 5.*—Start delayed by rain till 10; for three hours we sit cowering under a 'Msasa' (temporary hut of branches and reeds), for the rain came on just as the tent was struck. Pangazina goes on to find path—

hitherto none. We strike a well-beaten route, many 'goris' (slave-sticks) lying on the path; beautiful scenery; scattered trees; green hills, and numerous streams of delightfully cold water; no tropic tangle in the vegetation, but the grass still very dense and rank. Granite everywhere, but with more quartz and mica than on east side. A good deal of red soil, and evidence of iron. Outspan at a regular village of 'Misasa' (this is the plural of 'Msasa'), but have to move on account of a fetid odour which the men said proceeded from a dead body—a slave. Cross the stream Livisi, about twenty-five yards wide, with a strong current. By all accounts, the Livisi flows into the Lake, and not, as in Livingstone's last map, into the Lintepe. While we encamp, Pangazina goes on and brings back leaves of maize and pumpkin to show that he had reached gardens. This deserted country is very distressing, especially as one cannot help thinking what it might be without the slave-trade.

"*Tuesday, 6.*—Reached gardens and small wretched village of Kantunda's—the people conquered by the Ajawa about eight years ago. Obtained a guide to Tambala's, or rather (his son) Mlenga's, whose village is now in sight, perched on the top of a high conical hill. As we cross the summit of a slope, a gang of slaves is seen coming down the opposite incline. When they saw us they left the path, and hid in the long grass, so that I cannot tell exactly their numbers, but I think there were about forty or fifty. These also were for Mponda's from Chipeta's. I asked if Mponda's son was anywhere in the country, and the man pointed to a bed of grass where the wretched creature was hiding. No wonder he was ashamed to show his face. He brought a tusk over to our station not long ago, and was most lavish in his assurances that he and his father had given up slaving."

After a few days at Mlenga's and Tambala's, during which I saw a great deal of ivory and purchased a few tusks at very moderate prices, I returned by a different route. Tambala is very friendly and very loquacious. He seems most anxious to welcome the white man to his country, but will have nothing to do with Arabs or slavers. On the return

"it was impossible to get bearers to carry the food. They were afraid to go far from their village lest they should be enslaved, and even told the chief that they feared I should make slaves of them if they went. At the Kantunda village I tried again, but the poor creatures, though eager for cloth, would not be persuaded to come as far as the Livisi. The men want to sleep at this village, but I am sick of the noise and groups of staring people. They sat from morning to night, about a hundred, in front of my hut at Mlenga's, watching every movement of the 'chiroombo.' Never was I so glad to get away, even into this deserted country. We have pushed on to our last camp, where there is good water. This evening we passed a dead body lying near the path, with its slave-stick by its side. It was not there three days ago.

"*Friday, 9.*—Start 6.30. Pass another dead slave lying almost across the path, with his head hanging over a deep sluice—a revolting sight, and one that made me vow eternal vengeance against these murderers. We strike off by another path soon after crossing the Livisi. This route leads nearly due west to Pemba's. The range here dips down and allows a passage at an elevation of about 2500 feet above the Lake. The Nyanja comes in view. Many stoppages through the men climbing trees after wild fruits. I thought it best to allow them a little indulgence in this, for they have had very hard work. One fruit is a yellowish green ball about as large as a Tangerine orange, and has a raw-tasting pulp like a medlar; it is called 'malembe.'

Another is the "ntuza," a green plum with several stones. It is uncommonly good, and would make a fine fruit if cultivated. They are sometimes dark purple, like damascenes. Encamp at some 'misasa' 1000 feet above lake. Men wish to start early, for fear of meeting M'Pemba's people.

Soon after this short excursion I made preparations to go up the Lake in the *Herga*, but her mainsail had been almost completely destroyed by white ants, and I had to wait for repairs and also for Dr. Macklin, of the "Blantyre" mission, who wished to accompany me, and was to bring a white man as boatman (both of mine having already left the country).

"June 1.—My sail being now thoroughly repaired, I determined to make a start, and reach Elephant Island. My party consisted of M. (a boatman hailing from the Mission at Blantyre), myself, and six natives. I took 50*l*. worth of cloth and beads, and a good store of provisions; reached the island, and slept near the skeleton of the elephant killed by Mr. Young, under a dense tangle of huge creepers.

"June 2.—Off at six with south wind. Stood for Marere, and pulled in past the two mountains Tchenga and Lifu, then along a marshy shore to the point called Sandy Point in Livingstone's map, and found, where I pitched camp, shelter in a deep bay running some miles inland to the south. A huge elephant was standing about 200 yards off.

"June 3.—Passed Bengé Island. Glad to run into the entrance to Lake Chia. The mouth thickly beset with sunken rocks, but fortunately I hit off the only passage through them, and got into calm water to our great relief. On the north bank are two large villages, and a dense crowd of vociferating natives, who lined the shore and roofs of the houses to see the first European vessel enter their lake. To avoid their clamour, and not being sure of their feelings, I encamped on the south side. After a good deal of parley, one canoe ventured over, soon followed by many more, bringing fowls, &c. For the next three days the wind was too violent to allow us to move. I went about the lakelet in my dingy, taking soundings; the least depth was two-and-a-half fathoms. Chia is deeply fringed all round with papyrus, which would prevent the formation of a station on its shores. Maize, bananas and cassava are plentiful. Goats are dear; fish in quantities. They are almost exclusively of one sort: a white and black perch with a disagreeable grassy taste. The people came over in crowds, and were especially attracted by a book of animals ('Aunt Louisa's'). They were never tired of gazing at the elephant, leopard, &c., holding their hands before their mouths to express their astonishment, and giving vent to loud exclamations. No sooner was one set satisfied than twenty or thirty would present themselves, and ask to see the njobvu (elephant). I have to make a rule to show the pictures about once an hour, and often have some spectators.

"June 6.—Made a run to Kota Kota. The so-called island is merely a sandbank mostly under water. The bay gives good shelter, but is lined with reeds, so that there is no landing-place except at Jumba's Town. As soon as the *Herga* was descried, an immense number of black figures, relieved here and there by a white Arab dress, swarmed along the beach and over the roofs of the houses, yelling and gesticulating in a manner that was really a little alarming. There must have been some thousands of them. We had heard that Jumba was dead, and that Mankajira had taken possession of Kota Kota, and I was advised not to put in there. But I put a bold face on it, and stood right in for the village, running the boat's

nose aground in the midst of the crowd. Forthwith a rascally-looking fellow in a turban and Arab dress stepped up to the boat, and cried, 'Me speak English.' He knew about a dozen words of English, and did not understand Manganja. So we held a conversation, from which I learnt that Jumba's brother had succeeded him, and taken his name, and was ready to receive me. So I went ashore in the dingy with two of my men and a present. Jumba was most courteous and affable. He is a tall, consumptive-looking individual, with an unpleasant smile hovering over his face. I asked him to come and see the boat, which he did at once, and brought me two large baskets of rice and a goat. After he was gone, three of his wives came off. They were most extravagantly attired in petticoats (the first I had seen for nearly a year), silver bracelets, innumerable rings, &c. They were well-behaved, but by no means shy. Very complimentary, gazing with great admiration at my hair, which they pronounced 'abwino' (very nice). The town extends a considerable length along the shore. Many square houses, so closely packed one can scarcely make one's way through the place, which is a most filthy and evil-smelling hole. Many oil palms. Jumba has the red flag flying over his house."

From Kota-Kota I made a rapid journey before the south wind, and had nearly reached Mankambira's when I received a check, which the diary shall relate.

"*Sunday, June 10.*—I hardly feel spirit enough to begin another diary, sitting as I am amid the broken fragments and soaking bales saved from our wreck last night,—for a wreck it was to all intents, though the *Herga* is now hauled up high and dry, and not much damaged. Yesterday, after vainly attempting to run into the Lucia, we found a bay with a moderate shelter. I was rather anxious when I went to bed, and hearing the wind rising about midnight looked out. The fire on the shore attracted my notice; it seemed so small and far away. I called M., but he thought it was all right, and turned in again. But the fire seemed to be retreating farther and farther off, and I was sure that we were dragging, so I ordered the men to take down the awning at once. The wind increased in violence. We paid out all the chain cable, but got out into the open, and rapidly drifted north-west. The bay is full of rocks and shallows, and I was momentarily expecting to strike. Once I noticed the sea break on a rock within a few yards of me, as I sat at the helm trying to keep the boat's head to the waves with the help of two oars. Had we gone on one of those rocks half a mile from the shore we should have had little chance of saving our lives. It was an exceedingly anxious time. At last we again reached soundings, and the anchor held for a little time. M. gave it as his opinion, which I now think was a wrong one, that it was useless attempting to stand out to sea, or to run back into shelter. The sea certainly ran terribly high, and once broke over the boat, half filling her. As we approached land the waves were still more fearful, breaking all round us. I saw that we must go ashore, and collected various things in case of a plunge. When about forty yards off I flung a bottle of quinine and Livingstone's powder ashore, and it is the only quinine I have with me now, for as the boat struck I tried to heave my medicine chest ashore, but it fell into the water and was instantly swept away. I secured some matches in my cap, my watches, my 'express,' and some cartridges. M. jumped in directly she touched, and got a thorough drenching. I remained in the boat, hoping to save a few things; but the sea burst over me, and I was obliged to make a leap in the dark, and found myself only ankle-deep on a shelving sandy shore, and truly thankful I am that it was sand,—the only bit in the whole bay. Had we drifted on to the rocks, which are on both sides of us within fifty yards, it would have been a case of

saving one's life, and nothing else: and seeing that we should have had to walk back about 200 miles, without cloth, food, or guns, I do not know what would have happened. As it is, the *Herga*, after lying for ten hours in the surf, full of sand and water, was, with infinite trouble, hauled up on the sand by fifty natives. My poor little dingy is smashed to atoms on the rocks. She was washed away by a heavy sea, and I found her remains this morning. My medicine chest, sextant books, journal with every note and observation that I have made since coming to Africa, some cloth and beads, and many minor articles, helmet, clothes, &c., are gone, and a great deal else ruined. Thank Heaven, none of our lives are gone, and that the *Herga* is still safe! The loss of my notes, sextant, nautical tables, &c., will prevent me doing anything more of a geographical nature. But perhaps it is for the best, since one's thoughts may be easily too much taken up with such ideas. . . . I find that, besides my personal losses, two trusses of cloth and a box of beads are gone, and another box knocked to pieces, so that half the beads are lost. A good many were swept upon the shore by the waves, and the natives are busy hunting for them by sifting the sand. This morning the chief Kangoma, a brother of Mankambira, who has been of great service to me in hauling up the boat, brought three large tusks, of which I have already bought one (65 lbs.). There is evidently a great deal of ivory about here. Several more were brought this afternoon, and I have secured one of 30 lbs. and one of 10 lbs. for about three shillings a pound."

I here first came in contact with the real Mazitu—the "Maviui" of South Nyassa being a very inferior article. They proved very friendly, though I find in my diary that—

"The people at the village warned my men to tell me that the Mangoni (or Mazitu) were intending to attack us. The cloth laid out to dry on the sands seemed to have excited their cupidity. I do not wish to encourage any foolish fears of my men, but it will be foolish on my part not to be prepared for such an emergency; so I shall set a watch at night, organise a plan of defence, and keep the guns all ready. But I will try every means before resorting to force."

On June 13th, the journal says—

"The sea is far too rough to attempt a launch. The natives say the weather will alter at the change of the moon; this superstition (if such it be) seems universal. Huge yams for sale. About 4 o'clock as the sea fell, I got twenty men, and with much difficulty (for they demanded prepayment, and after being paid would not work) at last got her afloat, shipping a little water in the process. I at once made for Mankambira; but finding no shelter and many rocks off his village, ran on for the next point. It grew very dark, and we could find nothing but nasty rocks, round which the sea came swirling most disagreeably. I thereupon ordered Pangazina to swim ashore (he is as much at home as a crocodile in the water) and look out for an inlet. Soon afterwards we heard him shouting to us, and following his directions steered through some reeds, and found ourselves in a deep channel leading into a lagoon. People soon came to see the strange sight of a 'galawa ikulu' (big canoe) in their creek, and were at first alarmed at the apparition of my white skin. It was quite dark, but they noticed my hands; and as I heard them debating the matter among themselves, I lit the lantern, took my hat off, and let them know that I was not an Arab, and that I wished to be friends with them.

"June 14.—I had to move my camp higher up, for the sea rose and swept over the sand, extinguishing our fire and flooding my tent. I then walked

over to Mankambira's, about 3 miles s.w. On the way we passed the charred skeleton of a man who had been burnt (alive?) for poisoning people. This is a common accusation, and what real grounds exist for it I cannot tell. They call such a man 'mfiti.' Mankambira is tall, rather dignified and reserved; he has a good profile, with slightly aquiline nose. My present of cloth and a red umbrella pleased him much; and he loaded me with sugar-cane, &c., and sent a huge pot of beer (moa). Tais 'moa' beer is made of a mixture of cassava and a small millet, and not so good as 'pombe.' He came back with me to see the boat. The name of the creek in which the *Herga* is lying is Chirambwe; it cleared of weeds it would admit the steamer. In course of the day an Azitu chief came to see me (Kamoto). I was much struck with his high-bred demeanour. He was most friendly, and apologised for bringing me nothing but a little kid, because his village was distant, and he was here only on a visit. He had a Zulu crown of woven hair—an upright wall of six inches high, coped with a ring of bees'-wax; the rest of his head was shaved. With his feathers, red-cloth, and other ornaments, he was certainly very picturesque. I took photos of him and of Mankambira. The Nyassa women have often long, well-shaped faces, but they are all deformed by the hideous 'pelele' (lip-ring) which is worn here of a great size; white or yellow stone is the common material, but sometimes they are made of metal, and in that case are generally hollow—in fact, like a small tin pannikin. I bought fowls more than once with bits of tin or zinc."

I cannot try your patience any longer by describing any more of this voyage. Suffice it to say, that on account of the increasing illness of my boatman, I had to give up the idea of reaching the north end, and, after making many inquiries on geographical subjects, and hearing it stated most emphatically that no river ran out of the Lake, and having received a grant of land from Mankambira and the present of a tusk, I started southwards. After a long and most tedious journey, being delayed for days together at various points by the "Mwela," or south wind, and spending much of my time in malarious creeks and marshes, and having had a most providential escape from a leopard near Mount Tchenga, I at last, one night, sighted

"the lights of Livingstone gleaming across the bay. The men pulled double-quick at the sight. Voices were heard on the shore. They had seen my lantern, and had heard the splash of our oars when we were four miles distant, and were all assembled to welcome us back. I made for what I thought was the *Herga's* anchorage, considering myself to be about a quarter-of-a-mile off shore, when Dr. Law's voice was heard shouting out, 'Port, port, or you will be on the stumps!' In two minutes the boat had touched the sand, and I was walking up to the 'big house,' where supper had been hospitably prepared for me."

I am grieved to say that the poor boatman, whom I had expected to die every day for some time past, only survived his arrival a short time.

A large budget of letters was awaiting me, and I learnt that my friends in England were anxious that I should make an attempt to cross from the north end of the Lake to the coast, in order to see

whether a road was practicable by that line of country. Knowing that I could get men among the Makololo easier than on the Lake, I at once started off for the cataracts, and, after visiting Blantyre, reached the lower falls in August last. Here I met Captain Elton, who, with three friends, had come up to visit the Lake. As he also was anxious to return by a land route, we arranged to travel together from some point on the north or west coast of the Lake to Dar-es-Salaam, if we found it practicable. By the kindness of the Mission authorities, we were allowed the use of the little steamer—Dr. Stewart being himself anxious to visit the northern parts of the Lake. It was proposed that we should leave half of our men behind and remain at the north end until the *Ilala* could return for them—but our voyage took so much longer than we expected that this was found impossible: besides, the Lake proved so stormy and dangerous to the little craft (she was twice nearly lost on this journey) that it was considered advisable to give up the second trip.

We visited Kota-Kota, Lisewa (which is a good deal south of its usually assigned position), Dikomo, and Chitesi's, and then crossed and ran up the west coast. We were detained some days under Mount Chombi, which I ascended and found to be about 4000 feet above the Lake. As we neared the north end the weather became very stormy, and Dr. Laws was glad to run into a deep inlet, about lat. $9^{\circ}40'$, named Ruambadzi. The high land on the west of the Lake trends off a little below this in a N.W. direction, and, as far as we could see, leaves a flat marshy country extending towards the S. of Tanganyika, which was said to be about 10 or 12 days distant.

We landed at Malisaka, a village of the Wachungu. The people were very shy, and not very friendly at first. They were totally naked—though some vague traditional sense of shame seems to linger amongst them, for they sometimes hung a banana-leaf or a bunch of grass from their waists, and one man appeared with a scanty bit of fish-net as his only apparel, which was not very effective.

The chief Mbungu visited us, and, passing himself off as the great "mfumu" of the district (*i.e.* Makula), obtained a good present, in return for which he promised to supply us with men. But men were difficult to procure; they professed to be warriors, and would not carry: that was a woman's duty. Besides, they did not know the use of cloth, and did not want it. However, we at last made a start, having left much behind, with about fifty men. I was ill, and had to follow later in the day, carried in a hammock.

Our route crossed the Chombaka River, on the banks of which I spent my first night almost alone, having failed to catch up the main party. This I did, however, the next day, and found that every one of the carriers had disappeared in the night, having been prepaid for the journey of five days to Métére's. The whole of this country is covered with groves of banana. I must have sometimes passed through at least 5 miles of them at a stretch. We procured other carriers and ascended the Chombaka Valley, crossing the river several times, and passing two very beautiful little lakes. Kisewa was much like the Alban Lake, and looks almost as if it were the crater of an extinct volcano. To prevent the desertion of carriers we had to mount guard over them at night, and to place the head men in close confinement. On the whole, however, we seemed to have gained a certain amount of their confidence, though the appearance of white men in the country produced considerable excitement and a good deal of terror in some cases. Cattle abound, and were easily procured, as also sour milk and bananas, which form the principal food of the Wachunga. Their huts are circular, and beautifully built with bamboo, or wood, and oval bricks of sun-baked clay. They have very pointed, neatly thatched roofs, and the walls slope outwards, giving the hut the appearance of a beehive. On crossing the Chombaka for the third time at a point where it flowed through a very deep ravine, we struck more towards the north. A magnificent waterfall was discovered where the Luisi pours its stream down a steep cliff into the Chombaka Valley. Ascending and crossing this range, we found stretching away to the E. and S.E. a great plain bounded in the far distance by a towering range of mountains, that evidently ran up from the eastern side of the Nyassa towards the N.W., and were the continuation of what Mr. Young has named the Livingstone Range. The native name for these mountains and the surrounding country is Kondi. Several rivers intersected the plain, running in the direction of Nyassa. The slopes of the hills in Kondi are extensively cultivated, the beauty and fertility of the whole country far surpassing anything that I have seen elsewhere in Africa. We had been gradually ascending since we left Nyassa, and when we had reached Mazotes' (which we did after many desertions on the part of the carriers) we were at an elevation of about 6000 feet above the sea. The cool mountain air was most refreshing: the grassy slopes, rushing streams, the herds of cattle with their tinkling bells, the wild flowers—forget-me-nots, buttercups, heaths, and many old familiar friends—made it like a dream of Switzerland.

All the upper ridges of the hills were infested by robbers, who collected in considerable numbers on the heights, armed with great bundles of spears, to gaze at us. On one occasion about 200 of these brigands (called the Makauka) came down upon one of our party who was wandering almost alone some distance from the camp, but a bold demeanour and a display of guns kept them from actually attacking him, though they approached disagreeably near. The people of the valleys call themselves Wabena, though I believe they are Wasango, who have turned the Wabena out of this part of the country. Ukena proper is a small region to the north-west of this.

At Mazotes' all our carriers deserted us, and we were left high and dry on the top of a mountain ridge (6000 feet). The chief was ill with small-pox, and though he sent us a cow, he would not procure men for us—or rather men would not be procured. For some days we encamped there, enjoying the magnificent scenery and the highland breezes, but at last it was decided that some of us must push on to Mérére's town, which was said to be about two days to the north. All the Wabena and Wachunga acknowledge Mérére as sovereign chief. His "empire" (for it deserves, or deserved, that name) was said to extend from the Rufigi to Nyassa. So Captain Elton, I and another started off with about five of our own men and a guide, taking nothing but blankets, guns, and a small stock of food. Ascending a steep ridge, through forests of gigantic bamboos, we crossed the Kondi range by a pass 8800 feet above the sea, and found ourselves on a great plateau 7000 feet high, called Uwanji, a splendid cattle country, watered by many streams, among which the largest is the Wanji River. At the village of Wanji we heard rumours of war, and found that the people would not allow us to pass, nor supply us with food, till men had been sent on to Mérére to inform him of our arrival. So we made the best of it: built a "msasa," or grass hut, and eked out what little food we had for two or three days. At last, after many messages had passed between us, a chief captain of Mérére's—a splendid fellow with a huge head-dress of black plumes—came to interview us, and soon afterwards we were met by a young Arab and others dressed in Arab fashion, who had been sent by Suleiman bin Abed to escort us. This Suleiman is an Arab who has lived, it seems, at Mérére's for many years, and fortunately interested himself on our behalf. From Wanji one obtains a view towards the north through a gap in the hills, and we were conscious of a great plain lying below us in that direction. When we reached the edge of the plateau a magnificent scene presented itself. The

vast plain of Usango or Urori spread before us, intersected by many rivers—among which were the Ruaha, rising in a gorge at our feet, and the Ranga. We saw a lakelet into which the Ruaha and its affluents flow, and caught the gleam of a larger lake on the far horizon, into which the Ruaha pours its waters, and in which there are said to be two islands.

To the north-west the high plateau extends towards Usafa and the Lake Hikwa. This lake, which was said to be four days distant, is a salt-pan, or rather a saltpetre-pan, for the natives said that a kind of salt with which tobacco was cured was obtained from its banks. I have placed it considerably south of the position that it has hitherto held in maps, for the natives used to point almost due west when describing the route thither from Mérére's. From what they said, it must be about 30 miles in diameter. On this edge of the Uwanji table-land we were detained, for our guides refused to proceed on account of the Machinga, who were ravaging the country between us and Mérére's, and indeed we saw large bodies of the enemy spreading themselves over the plain, while the smoke of burning villages rose from various parts. At an outpost of Mérére's warriors, perched on a rocky knoll, we waited for some hours, but at length, overcome by hunger and impatience, we descended to the plain, where we found a burning village, and helped ourselves to the half-burnt maize that was lying scattered on the ground. Hereupon a band of the Machinga came rushing down upon us with yells, and all but our own men—and they behaved very well—took to their heels. The Machinga, when they caught sight of our white faces, and saw that we did not mean to budge, halted, performed a series of defiant dances and retreated. We wished to keep ourselves clear of the quarrel between these two tribes, and, though later events made it difficult, tried our best to act merely on the defensive. It was, however, necessary to see Suleiman and Mérére, otherwise we should have been detained for an indefinite time in the country, and probably starved to death. So we determined to go on. We waited till evening. It was a moonless night, but Venus and Jupiter were very bright, and the burning village threw a red glare over the whole country. Escorted by some 60 warriors fully armed, and with faces smeared with white pipe-clay (most fiend-like objects), we silently and slowly wound our way along the base of the hills by unfrequented paths, often halting while our advance-guard went forward to make reconnoissance, creeping along the beds of streams (what a terrible noise one's boots *would* make!) till we came to the Ruaha. Here the banks were very steep, and it was with great

difficulty that we crossed without alarming the enemy, whom we could plainly see and hear as they sat round their camp-fires. At length we found ourselves outside a strong stockade, and after a long parley, carried on in whispers, were admitted into Mérére's "boma." We fancied that this was Mérére's town, but found that it was merely a stockade, built on the bend of the river, about 100 yards in diameter, closely packed with miserable little grass huts. The place was in a horrible state of filth, and its odours, together with that from the numbers of unburied corpses lying outside, were almost unbearable. From the crow's-nests next morning we saw the long lines of trenches and camps with which the place was surrounded. There must have been at least 3000 of the besiegers, and we numbered about 600 besides women and children. At first they were very bold, and made various assaults on the stockade, in which they lost many men. Then, in despair of taking the place, they had dug trenches, formed camps, and evidently meant to starve us out. One horrible act they committed the day before we arrived. In their rage at being repulsed, they had collected about eighty of their prisoners, all women and small children, and had deliberately massacred them in full sight of the besieged. I remember afterwards coming suddenly upon this heap of corpses—mostly those of little children—and turning quite sick at the sight. Suleiman had received us very warmly, and gave us the last of his rice and a bit of rancid buffalo meat, which we were very glad to get, for a cake or two of "maëre" (a small indigestible millet, the flour of which is about as good as inferior saw-dust), was all that we allowed ourselves daily. Once or twice one of our men managed to catch some tiny fish in the Ruaha, but one night he was shot at (by one of our own outposts, who mistook him for an enemy), and wounded in the leg, so we forbade him to fish any more.

About four o'clock every morning there was generally an alarm or an attack, and I used to find myself rushing down, rifle and revolver in hand, to the stockade, generally to find the affair all over and the enemy repulsed with loss. All day long bullets used to be flying about; but not much damage was done to us, although I generally had a good many patients to visit. The constant drumming, the yells of the outposts jeering at the enemy and imitating the cries of cows, sheep, and goats (to make the Machinga believe we still had such animals in the stockade), kept one awake at night, and the horrible smells and hunger made us begin to think of attempting a sally; but Suleiman and Mérére begged us to wait a few more days, declaring that forces were being collected

in Kondi to relieve us. Things had come to a bad pass, when before dawn on the 5th of November, we were as usual called up by our men, and, as was our wont, snatched up our guns and hurried down to the stockade. But instead of an excited throng of warriors brandishing spears and letting off their firelocks into the darkness, we found a crowd of men, women, and children quietly gazing at long lines of burning huts, blazing in all directions. It was the most glorious 5th of November bonfire! The enemy, having heard of the approach of the Makangwala who were advancing to our relief, had fired all their camps and were in full retreat. Mérére still, however, suspected a feint, and ordered his warriors to remain within the stockade. But we did not agree with him, for we saw the vultures swooping down on the trenches and stalking about the deserted camps, so Elton and I walked out, he with a shot gun, in hope of bagging a dove for breakfast, and I with no gun at all. We found the camps and trenches deserted, and the whole ground strewn with skeletons and corpses. Then the whole population of the "boma" poured out. Large bodies of men were sent to pursue the enemy, and returned day after day with ghastly trophies, the hands of the slain stuck on the points of their spears. We then sent for our rear party and goods, which had remained behind at Mazotes'; but it was three weeks before we could persuade Mérére to give us carriers, and even then we only obtained forty boys. During these three weeks we shot a great deal of game, mostly zebras and buffaloes, for the meat of which the poor starving people were most thankful. We were all of us rather pulled down, and I fancy that poor Elton's health never recovered from the hardships he suffered at Mérére's.

We had always congratulated ourselves on at least having the pure water of the Ruaha to drink, and bathe in; but ceased to do so when we found that the Machinga had thrown about thirty putrid bodies into the stream just above the stockade. At length we most gladly said farewell to Mérére and Sulieman, and started off towards the north-west, for the direct route down the Ruaha and Rufigi was closed by wars. Our destination was Mkongora's, about 30 or 40 miles south of the Unyanyembe caravan-road. We expected to reach it in ten or twelve days, and had no idea but that we should be able to obtain food on the road here and there. While we were still on the great plain of Usango game was plentiful, and we were very fortunate in bagging a good deal; but when we reached the hilly Niam-Niam country we found it completely deserted, all the people and cattle having taken refuge in the mountains of Usafa. Mérére's great stockaded town, the

largest by far that I have seen in Africa, which lay on the Mambi, an affluent of the Ruaha, we found completely destroyed. Mérére himself had burnt it, thinking it too large to hold against the Machinga.

Luckily we obtained some wild fruit here and there, and with the help of a little "Liebig," held on pretty well till we reached the river Mzombe—having made a long *détour* on account of the Machinga and Waruga, who were still scouring the country.

Then came a few days—about six—of pretty nearly famine fare. I remember my intense joy when I managed to shoot a couple of parrots with one of our last cartridges; and on the day before reaching the village, I know I was in a very faint and staggering condition, and would never have got through had not poor Elton shared with me a small mud-fish that was caught by one of the men, and purchased at a high price. I have never tasted anything half so delicious as the flesh, skin, bones, and tail (I had the tail end) of that mud-fish. In the evening I came across a wild fig-tree, and made a good meal off the unripe fruit. The rest of the party had pushed ahead and arrived at Mkongora's; but I was benighted, and spent a miserably wet night in the bush, and was carried in by my men next day.

At Mkongora's—or rather Kagowa's, for Mkongora had been ejected by a late revolution—we procured plenty of food—goats, grain, and honey. Then, hiring new carriers, we set off for Usekhe, where we hoped to meet some Arab from whom we could procure cloth, for ours was at an end. Crossing the Makasumbi river we found ourselves in an undulating country covered with thick bush. Here poor Captain Elton began to break down. We carried him for two days, and when we reached the Kasigo he became worse. But we thought it best to push on, for the rain was violent at nights, and our food was finished. Between the Kasigo and South Usekhe (about 10 miles to the south of the Usekhe described by Speke, Cameron, and others), there is a broad plain with parklike timber, where large flocks of ostriches were sighted. South Usekhe is a collection of large "tembes"—quadrangular cattle-kraals. Here, after remaining unconscious for fifty hours, our poor fellow-traveller breathed his last. We buried him—though not without encountering much difficulty from the superstitions of the natives—under a large baobab-tree, about 3 miles to the S.E. of the village. After this sad event we most fortunately discovered that a numerous caravan was encamped at North Usekhe, and were hospitably received by the chief Arab, Hamram Selim, who provided us with cloth (at, however, rather a ruinous price), and gave us

presents of coffee, sugar, and curry, which were, as might be supposed, most acceptable.

We then had to traverse some 350 miles of the Ujiji caravan route—a journey that I shall not describe, for it has already been fully described by various travellers. It will be enough to say that we followed nearly the route laid down as Mr. Stanley's in Livingstone's map—that we found the Wagogo very insolent and disagreeable, and could scarcely procure food enough though the country teems with cattle and sheep—that we found Mr. Thompson and M. Broyon in Usagara lamenting the loss of almost all their draught oxen—that we had a wet time of it for two days across the Mkata swamp, finding the water waist high in many parts and chin high in others—that we passed eight terribly anxious days while one of our party lay between life and death with an attack of sun-stroke—and that we were nearly mad with joy when “the sea, the sea,” first burst upon our view—and, finally, that on our arrival at Bagamoyo we found H.M.S. *Vulture* awaiting us, and on the last day of February we reached Zanzibar, having spent four months and a half on the journey of about 1000 miles from Livingstonia.

The PRESIDENT said Mr. Cotterill had furnished them with a very interesting and instructive example of the perils, the trials, and the sacrifices, which African exploration necessarily entailed. He (the President) had had an opportunity of seeing Consul Elton's journal, and the care and precision with which it had been kept were perfectly marvellous. It was kept from day to day in minute but very distinct writing, with scarcely an erasure, and formed a thick octavo volume. It testified to the earnestness and determination with which so many explorers entered Africa; and the least that could be done, when, as in Consul Elton's case, they never returned, was to thoroughly appreciate the self-sacrifice which they had manifested.

Mr. W. H. WYLDE stated that Captain Elton's journal and other papers had been in his possession, and that it was almost unnecessary to say that he had read them with extreme interest. A better-kept journal it had never been his fortune to see. At present it was in the hands of Mr. Murray, and he hoped that before long it would be given to the public. Not the least interesting portion of the papers were the sketches. He had never before seen such beautiful sketches in so few lines, or drawings that gave a more admirable idea of the scenery and country through which the Expedition passed, and the water-colours and etchings showed the hand of a perfect artist. In losing Consul Elton the public had lost a most valuable servant, whom it would be very difficult to replace.

Mr. JAMES STEVENSON said he had listened with extreme interest to the details which had been given of Captain Elton's expedition. Two years ago Mr. Cotterill and himself discussed the question of the possibility of making such a journey, and introducing legitimate trade into that part of Africa. Since Mr. E. D. Young last year addressed the Royal Geographical Society on the first circumnavigation of Lake Nyassa in the Livingstonia mission steamer, a road, 65 miles in length, had been made by Mr. James Stewart, C.E., past the cataracts of the Shire, and what would on an American prairie be termed “Blantyre city” had been founded midway upon it. The “city,” however, consisted of five or six small huts, which it was hoped would be

the germ of a considerable community. In Livingstonia thirty or forty children, among whom were the sons of several of the Makololo chiefs of the Shiré valley, and an equal number of adults, constantly attended school and religious services. This afforded a contrast to the picture which Mr. Cotterill had given of the north end of the Lake. Captain Elton had been at these stations, and took great interest in them. He visited the schools, and examined the children himself. The second circumnavigation of Lake Nyassa had produced some useful results after Mr. Cotterill left. On the disembarkation of Captain Elton's exploring party at the north end, the steamer waited ten days to be ready to receive them, if any mischance befell them. An attempt was planned to explore the district around; but the natives became alarmed, and refused to supply a single carrier. At the end of ten days things seemed to come to a head, and an attack on the steamer was feared. They therefore sailed out of the inlet in which they had been quietly lying; trusting that when they came back again, the distribution of goods that had been made would lead the natives to feel that there were advantages to be derived from communication with white men. They went some distance to the south, where they found a people who were much better disposed to receive them. There was an excellent harbour there, which some day or other might be made available as the starting-point to Tanganyika, which was not more than 120 or 130 miles from Lake Nyassa. Further south they discovered two more harbours, so that the Lake might now be circumnavigated and good anchorage found every night. An exploration was made for 100 miles north of Kota-Kota, through a very fine reach of country, where it was hoped another station might be founded. In this exploration the party had a visit from a tribe called the Mazitu, who had migrated from the Zulu country. Some of them came on board the steamer, and one of the natives from Lovedale happened to have his Bible with him, opened it, and read the parable of the 'Prodigal Son.' It was evident that the visitors quite understood it, and immediately afterwards began to talk about old Zulu-land in a very familiar way. The friendly disposition of these natives would, no doubt, enable fresh discoveries to be made, and lay the foundation for a great improvement in the population of that district.

General BEAUCHAMP WALKER said that, nearly twenty years ago, he was in command of a regiment in India, when a bright, cheery-faced boy brought up a remount of horses from the south. Two days afterwards, one of the Majors said to him, "Colonel, you want an interpreter; I think Elton will just suit you. We all like him very much. He speaks the language very fairly." He sent for Elton and had a chat with him. He found that he knew the language quite enough for his purpose, and that moreover he came from his (General Walker's) own part of England, the West. He engaged him as interpreter, and, though there was a difference of nearly twenty years in their ages, they became almost inseparable companions. They rode together, shot together, and a more engaging companion than poor Fred Elton he had never met with. When he (General Walker) left Lucknow to join the China Expedition, Elton remained as interpreter with the regiment; but to his great surprise, when he reached the north of China, he found Elton serving as a subaltern with one of the Sikh regiments. He was very highly spoken of by his commanding officer, and, on the day when Peking was virtually taken, he distinguished himself by great intrepidity and presence of mind. He then lost sight of him, but years afterwards, when in Germany, he met a French officer of Zouaves, who was attending the German manoeuvres, who asked him, "Did you ever know a young officer named Elton?" His answer was, "Oh yes, he was a great friend of mine;" and the French officer then said he had met him in Mexico, that he was a capital fellow, always cheery and full of fun. A few months after this, a German Captain of Dragoons told him the same story. Elton appeared to

have been liked by everybody with whom he came in contact; for he was cheery, light-hearted, and full of enterprise. He next heard of him as British Consul at Mozambique; and since his return to England the very Major, who first recommended him as an interpreter, had told him that Elton was still in Africa. It was now a great grief to him to hear of the sad end of such a promising young man, and he was very much obliged to the Society for allowing him to say these few words about him.

Mr. HUTCHINSON (of the Church Missionary Society) said until the mail arrived nothing more could be known about the deaths of Lieut. Smith and Mr. O'Neill. It was known that they had been favourably received by M'tesa, and that every encouragement had been given them to commence a mission at his capital. Mr. Wilson, the ordained member of the party, remained there on the first visit, and Lieut. Smith and Mr. O'Neill returned across the Lake to bring up stores. In the last letter received, dated October 29th, Lieut. Smith stated that he intended to explore the Shimeeyu River, leaving Mr. O'Neill behind at Ukerewe in charge of the stores and to fit up the dhow which Mr. Stanley had seen preparing for the slave-trade. Mr. O'Neill appeared to have joined Lieut. Smith, and therefore it was not likely that their deaths had occurred in the neighbourhood of the Shimeeyu River. It was probable that, on returning north, they were met by baffling winds, and the dhow not being very manageable, and the *Daisy* not quite suited to the weather, they might have been driven ashore, and so met their end. The Church Missionary Society were not disheartened by this disaster. Men were at hand who would supply their places, but the result would probably be that, instead of using the Lake as their water-way, and making Kagéi their base of operations, they would revert to their old plan of establishing intermediate stations to Rumanika's country, and so get to Uganda. Colonel Gordon had offered them facilities for reaching Uganda through Egypt, and it was hoped that very shortly two men would start on the Nile route to join Mr. Wilson. The Church Missionary Society readily recognised the obligations they were under to Mr. Stanley for the work he had done; and, although Mr. Wilson was alone, they felt that he was perfectly safe with King M'tesa, and they hoped to strengthen his hands and re-establish the work which at the present moment seemed to have met with a check. Mr. Cotterill's Paper was full of deep interest to all who were concerned in the welfare of Africa, and he trusted that the scheme for carrying a road to the end of Lake Nyassa from the East Coast would not in any way be frustrated by the difficulties he encountered.

2.—*On Overcoming Geographical Obstacles to African Trade, by economical Animal and Mechanical Expedients.* By J. L. HADDAN, M.I.C.E.

[ABSTRACT.]

IN this Paper the Author dilated on the advantages in a country like Africa of the "Pioneer Railway." The chief features of this newly-invented system consisted in the employment of one rail instead of two, and the non-requirement of cuttings, sleepers, system of signals, &c. "The Pioneer," he said, "is readily transportable; it follows the natural undulations of the ground, without disturbing the soil; it requires neither banks or cuttings, and does not interfere with the watersheds, a most important element in the tropics.

The rolling-stock is handy, and can be shipped in running order; the engine weighing only 4 tons." The horizontal-grip system of driving, adopted in the "Pioneer" locomotives, "destroys impetus; so that such a train may with safety run fast down inclines, which an ordinary railway could not face." "The carrying value of the line will not exceed 100 tons daily: for which an eminent Glasgow firm tender at 750*l.* per mile." The Author concluding by hoping that in order to prevent more valuable lives from being lost by explorations, the base of operations may, by means of this cheap railway, be so far advanced into the interior, that explorers may not be worn out before they can reach new ground. A model and pictorial sketches were exhibited in illustration.

Mr. STANLEY, on being called upon by the PRESIDENT, said that his object in attending the Meeting was to do honour to the memory of his friend Captain Elton. When he left Zanzibar to cross the continent, the last man from whom he parted on the beach was Captain Elton, who said, that in whatever part of the world he again met him his house would be open to him. On his voyage from the mouth of the Congo to the Cape of Good Hope, and thence to Natal, Mozambique and Zanzibar, wherever he landed he heard as much praise of Captain Elton as any man would be ambitious of. When he arrived at Mozambique he found Captain Elton was not there, but his house was a Bachelor's Hall, free to everybody. There were in it canoes from the Nyassa, bows and arrows from the Manganjas, spears from the opposite side of Lake Nyassa, little *curios* and objects of native art and industry from the Limpopo, and nicknacks from all parts of South Africa, in addition to the contents of an ordinary English library. He was some days at Zanzibar, hoping Elton would come, and when he left in the mail steamer on the 13th December, his last words were, "when Elton comes, give him my best compliments." Suddenly, a week or two ago, he heard that his friend was dead, and the shock that he experienced could easily be imagined. Soon after came the sad report of the death of the two missionaries of the Church Missionary Society. It would naturally be supposed that he felt an interest in them, as he had appealed to English philanthropists to send a mission to Uganda. There was no reason in the world why the Nile should not be used, for by that route an energetic man could reach Gondokoro from London in two months, and forty days afterwards he might shake hands with Mtesa. The natives of Uganda were very amiable, but it must not be expected that every African was just as polite as English gentlemen. He wished to tell Mr. Hutchinson that any young gentleman who went from an English University to Central Africa must take with him a fund of common sense. Whenever he met a white face in Africa he might be sure of meeting a gentleman, but it must not be taken for granted that God had made the savage and the white man the same. There were amiable tribes and unamiable tribes, gentle savages and ferocious savages, martial tribes and pacific tribes, and the man who had a fund of common sense would learn to detect which was which, and be guided accordingly. He would learn to judge by the minutest action of the savage. No Christian in England would be more ambitious to preach the Gospel in Africa than himself, had he not already buckled on the spurs of an explorer. His work was that of a pioneer to clear the way. All he could do for mission work was to give the best advice in his power to the missionaries who went out there. If he said, "This man is a savage," they might rest assured that he

had cause for saying so; if he said, "This man is a pacific man," it would be because he had found him so. From Zanzibar to Kagehyi there were only the Wanyaturu that he had to complain of, all the other tribes were as amiable as could be. If the missionaries who went to Uganda were devoted to the Gospel, why need they go to Mmweré, where the natives would tell them they did not want them? He had no doubt that Lieutenant Smith and Mr. O'Neill had fallen at Mmweré, or somewhere in the neighbourhood of its coast. He was very sorry indeed that the mission had met with such an accident, but he would say to Mr. Hutchinson, "Send your missionaries up the Nile, and they will arrive in Uganda without any trouble at all." Colonel Gordon was a guarantee that they would do so, and when they arrived in Uganda they would find an empire of 70,000 or 80,000 square miles, with a population of two and a-half millions, which would afford ample work for three or four missionaries. If the whole of Africa was to be civilised at once, fifty or sixty missionaries would have to be sent out, but until their work was accomplished in Uganda, the missionaries should put a placard, "Beware of the dogs," over such islands as Bambireh and Uvuma.

With regard to Mr. Haddan's machine for civilising Africa, he would be very sorry indeed if the 'Daily Telegraph,' or the 'New York Herald,' or any other great organ of public opinion, had sent him single-handed to build a railroad across Africa. What Mr. Haddan should do was to get a number of English capitalists to form an East African Company similar to the old East Indian Company. The British Empire has not yet begun to demonstrate what it was capable of. If they once reached Karagwe by the "Pioneer," or any other railroad, they would soon annex 6,000,000 square miles of territory. There were plenty of opportunities for trade on Lake Victoria, with its coast-line of about 1100 miles. Usongora produced cotton; Uganda, ivory, furs and skins; Uvuma, hides; Usoga, magnificent timber; and a great number of other countries would bring their produce for the benefit of commerce when once steamers were launched upon the Lake, and some such plan as the "Pioneer" connected it with Zanzibar. But it was useless for a small capitalist to think of doing anything for the good of Africa.

Commander CAMERON said he had never had the pleasure of Captain Elton's acquaintance, but he had seen some of his maps and sketches at the Foreign Office. He had thought that he himself had done a little in mapping, but compared with Captain Elton he was only like a man whitewashing a wall in contrast with a Royal Academician. The way in which Captain Elton's maps were drawn left nothing to be desired. Even the maps which were made within three or four days of his death might be photographed and published without being re-touched. The work which had come home as his legacy to the country was simply marvellous. Mr. Cotterill, whom he had known previously, had in a great measure demonstrated that legitimate trade was not such a hopeless thing in Africa as a few years ago it was considered.

It might be thought that Mr. Haddan's scheme for opening up Africa by a railroad was also hopeless; but it had been fairly worked out in some instances. As no earthworks were required, the railroad could be transported from one place to another, according to the necessities of trade. Mr. Haddan's scheme illustrated the axiom of the unit of weight being equal to the unit of traction. The train would go up an incline of 1 in 7, and would thus be fitted to cross mountain-passes. It was originally intended to lay down such a line in Turkey and in Asia Minor, but the political difficulties which had arisen had prevented the execution of the design. He had no doubt that if such lines had been laid down, the "Pioneer" Railway would by this time have occupied a very high position in the quotation of shares. Mr. Fowler was constructing a railway across the Soudan similar to the railways in

England; but Mr. Haddan's railway would have fully answered the requirements of such an undeveloped country, and would have entailed only one-sixth of the cost. Sir Fowell Buxton and others were now constructing a road from Dar-es-Salaam towards the interior. It was already open for a certain distance; and although it did not pay a dividend to those who had constructed it, having been made in the purest spirit of philanthropy, it did pay a dividend to the people in the surrounding district. A great deal of the work to be done in Africa must not be expected to return satisfaction to English pockets, but to English hearts and minds. The Map-Curator of the Society had shown him a model of a steamer that he had seen on the upper waters of the Fraser, and with such steamers, and the "Pioneer Railroad," communication might be opened up through the Nile, the Congo, and the Zambesi, into the very heart of Africa. He hoped that the "Pioneer" would be tried in the Transvaal, to connect the Diamond and Gold Fields with Cape Colony.

Tenth Meeting, 8th April, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*S. R. Van Campen, Esq.*

ELECTIONS.—*Alexander Cumming Bailie, Esq.; A. John Gardner Bain, Esq.; George W. Field, Esq., D.D.S.; Norris Tildesley Foster, Esq.; J. L. Haddan, Esq., M.I.C.E.; John Henry Hadwen, Esq., M.A.; R. T. Jones, Esq.; Major Robert Owen Jones, R.E.; William Kirby, Esq.; James Sivewright, Esq.; Robert Paulson Spice, Esq.; Reginald Earle Welby, Esq., C.B.; Daniel Whalley, Esq.; Rev. George Cosby White; Sparks Henderson Williams, Esq.*

DONATIONS TO THE LIBRARY, MARCH 25TH TO APRIL 8TH, 1878.—Publications of the Dépôt des Cartes et Plans de la Marine, Nos. 572, 574-577, 579-581 (*The French Admiralty Office*). North-East Madagascar, by J. A. Houkder; South-East Madagascar, by J. Sibree; and translation of Megiserus's account of Madagascar, 1609, with Notes by J. Sibree (*J. Sibree, Esq.*). Mr. H. M. Stanley and the Royal Geographical Society (*Col. H. Yule and H. M. Hyndman, Esq.*). Nitrate and Guano deposits in the desert of Atacama (*The Chilean Minister*). Natural History of Euplectella aspergillum, &c., by Capt. W. Chimmo (*Author*). The Civilisation of South-eastern Africa, by J. Stevenson (*Author*). Créations d'observatoires circumpolaires, par G. Gravier (*Author*). Dell' Arrivo fra i Niam-Niam, &c., di C. Piaggia (*Author*). Bemerkungen zur Kartenskizze des Weges von Tokio bis Yumotto, &c., and Local-attraction beobachtet auf dem Gipfel des Futarasan, von E. Knipping (*Author*). Boletín del Ministerio de Fomento de la República Mexicana, II., Nos. 9-23 (*The Mexican Minister*); and the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM MARCH 25TH TO APRIL 8TH, 1878.
 —French Charts, 31 sheets (*Dépôt des Cartes et Plans de la Marine*).
 Ethnographische Karte von Russland, 2 sheets (*Dr. A. Petermann*).
 Turkey in Europe, 16 sheets (*Quarter-Master-General's Department*).
 United States Charts, 2 sheets (*Commodore Wyman, U.S.N.*). Die
 Europäische Türkei. Ost-Russland und Kaukasien. Die Staaten
 der Balkan-Halbinsel nach den Grenzbestimmungen des Friedens
 von S. Stefano, 3 März 1878. Neue Aufnahmen in Nord-Australien,
 nach Ringwood und McMinn (*Dr. A. Petermann*).

The PRESIDENT, on taking the Chair, announced that the Council that day had awarded the Gold Medals of the year as follows:—

The Founder's Medal.—Baron F. VON RICHTHOFEN. For his extensive travels and scientific explorations in China, during which he mapped a great part of the Northern and Central Provinces of the Empire, and made observations of great interest and originality on their Physical Geography; also for his great work now in course of publication, in which the materials accumulated during his long journeys are elaborated with remarkable lucidity and completeness.

The Patron's Medal.—Capt. HENRY TROTTER, R.E. For his services to Geography, in having conducted the Survey operations of the late Mission to Eastern Turkistan, under Sir Douglas Forsyth, which resulted in the connection of the Trigonometrical Survey of India with Russian Surveys from Siberia; and for having further greatly improved the map of Central Asia by uniting his own work on the Upper Oxus with the exploration of the Mullah and Havildar further to the West, so as to give, for the first time, a nearly continuous delineation of the course of the river, from its sources in the Pamir Lakes to the frontiers of Balkh.

The first Paper to be read was by Capt. Gill, on his travels in Western China and on the eastern boundaries of Tibet. Part of his journey was along the route taken by the late Mr. Margary, who was killed on the borders of Yunnan and Burmah. The second Paper would be by Mr. T. W. Goad, on the United States' Topographical Survey of New Mexico.

1.—*Travels in Western China and on the Eastern Borders of Tibet.*

By Captain W. J. GILL, R.E.

[ABRIDGMENT.]

BEING at Shanghai in January last, anxious to see something of the little-known Central China, I was not slow to accept an offer made me by Mr. Consul Baber, whose name is well known in connection with the Grosvenor Expedition, that I should accompany him to Ch'ung-Ch'ing.

Thence I travelled by myself for a couple of months through Tzŭ-Liu-Ching, Ch'êng-Tu, Li-Fan-Fu, Sung-Pan-T'ing, Lung-Ngan-Fu, and back to Ch'êng-Tu, where I was joined by Mr. Mesny, a gentleman whose long service under the Chinese Government, and

intimate knowledge of the language and ways of the people, enabled him to render me the greatest assistance, and to whom I am mainly indebted for the admirable and friendly relations we always maintained with the officials and the people.

With him I travelled to Ta-Chien-Lu, Lithang, Bathang, Atentze, Tali-Fu, Yung-Ch'ang, Têng-Yüeh-T'ing, and Bhamo, whence an English steamer took us to Rangoon.

Of the journey to Ch'ung-Ch'ing I need say but little: it has been admirably described, and the route accurately surveyed by Blakiston.

At Ch'ung Ch'ing we were fairly in the province of Ssü-Ch'uan, one of the most beautiful, perhaps the richest, and for foreigners, certainly the most pleasant in the empire; endowed by nature with every charm of variegated scenery; giant mountains in the north, of whose peaks of perpetual snow little more has been known, than the wild statements of ancient geographers, that one of them attained a height of 36,000 feet; fertile plains, where in the driest season the rice-crop never fails; and undulating hills, where streams have cut deep channels in the soft sandstone. The hand of man has not been slow to utilise these advantages; everywhere the hills are laid out in terraces for cultivation, irrigation is carried on to an almost inconceivable degree, and, although the inhabitants have not learnt the art of making water run up hill by itself, one of the most remarkable features in a Ssü-Ch'uan landscape is the sight of the countless contrivances and water-wheels by which water is raised.

Riding down a stream, I have seen as many as twenty or thirty wheels, 24 feet in diameter, turned by the current and lifting water at the same time.

Standing on the top of some hill and looking down on a plain, dotted over the landscape a number of mushroom-like objects are observed, which, on close inspection, turn out to be the umbrellas under which coolies sit, and all day long, by a species of little treadmill, lift the water from one field to another.

Nor is art neglected by the gentle people of this happy province, and the traveller, as in the evening he nears his journey's end, long before he arrives at the city where he is to sleep, is made aware of its vicinity by the numerous triumphal arches built across the road. These—ornamented with rich carvings, most artistically finished, of household scenes or official duties—have generally been raised by some widow to the memory of her deceased husband; and in these the design is as elegant as the workmanship is finished. The careful way in which everything is roofed here must strike the eye of any traveller.

Houses, gateways, bridges, triumphal arches, and, indeed, almost

wherever it is practicable to put a roof, there one is sure to be; even the walls are often coped with glazed tiles, so that the timber-work, being built in the most solid manner and carefully protected from the weather by an efficient covering, lasts an incredible time, even in a country where rains and snow are regular in their occurrence.

Besides the officials, the people of this province are mostly either merchants or agriculturists, the literati—that generally highly-favoured class in China—being held in light esteem by the men of Ssü-Ch'uan; and to this is probably owing the fact that foreigners are always treated with great politeness, as wherever opposition to foreigners is carried to any great extent, it will generally be found to be owing to the influence of the literati class. This was, I believe, the case at I-Chang when there was some rioting, to which I have referred; and during my stay at Ch'ung Ch'ing the literati of that place posted an inflammatory placard in very bad rhyme, which Mr. Baber translated into very good verse. This was, perhaps, not quite so witty as it would have been had he been the author instead of the translator. The placard seemed to be treated by the people there with the contempt it deserved, and throughout my wanderings in Ssü-Ch'uan I never heard an uncivil word. The dominant characteristics of the Chinese race are inquisitiveness and curiosity, and in this the people here are not behind their countrymen of other provinces. In some of the towns, however, their natural politeness seems to overcome even their curiosity, and I have often sat with my door open to the public thoroughfare, engaged in writing—an occupation that always caused the most profound interest—and have been left completely undisturbed.

The agriculture of the Chinese has, I think, been somewhat overrated. The chief point in which they are superior to other nations is the exceeding care they take that nothing be wasted. Nevertheless the people is eminently an agricultural one. In their ways, their customs, their buildings and their food, there is a wide distinction between them and the pastoral races that are found on their frontiers. In the habits of these there always remains a trace, and often something more than a trace, of the nomad life; whilst in China proper and amongst the Chinese everything betokens the ancient and high civilisation of a people that have taken root in the soil.

In every city and almost every village in China inns are found, an indication of a people accustomed to live in houses, and who when obliged to travel must have a roof to shelter themselves; the very coolies, poorly as they are paid, never sleeping in the

open, but invariably expending some portion of their small earnings for night accommodation. Amongst the Tibetans, and in the Mantzu or barbarian population in the mountains, this is not the case; the people all originally leading a wandering life, the idea of inn accommodation has not penetrated into their habits. A Chinaman will under no circumstances sleep outside if he can help it; in Tibet the master of a good house will as often as not be found passing his night on the flat roof; whilst the hardy people in the winter time can sleep with their clothes half off, and their bare shoulders in the snow. In China no house is complete without its table, chairs, and bedsteads, rough and clumsy though they often are; in Tibet these accessories of life in a fixed habitation are always wanting.

Amongst the Chinese, mutton can rarely be obtained at all; they themselves think it very poor food: the love of a Mongol for a fat-tailed sheep is proverbial, and the natives of Tibet are not behind them in their taste. Although not exactly forbidden by their religion, the idea of killing an ox is very repugnant to the agriculturists of China, because—they say—it is ungrateful to take the life of the useful animal that draws the plough, and in the large towns the butchers are nearly always Tatars. The Chinese, as they never were a pastoral people, never kept flocks and herds; milk and butter are therefore practically unknown to them: Tibet may safely be called a land flowing with milk and butter; the enormous quantity of the latter consumed by a Tibetan is something startling—butter in his oatmeal-porridge and huge lumps of butter in his tea.

The ordinary food of a Tibetan is tsamba, or oatmeal-porridge, and buttered tea.

As a rule he does not drink much milk, partly because it is all made into butter, and partly because, owing to the filthy state of the vessels, milk always turns bad in a few hours; but the traveller who makes his tastes known can always obtain an unlimited supply. Tea is often brought to him made altogether of milk without any water at all. The Tibetans also eat sour cream, curds, and cheese; and this brings a Tibetan bill-of-fare to an end, which, in its constituents and in its simplicity, bears the stamp of the nomad pastoral race.

The Chinaman, on the other hand, loves variety. In every tea-house by the wayside that owes its existence to no more opulent class than the coolies on the road, there are always several little dishes of some sort. Beans simple, beans pickled, bean-curd, chopped vegetables in little pies, macaroni of wheaten flour, macca-

roni made of rice, these—and in the large towns and cities, dozens of dishes made of ducks, pork, fish and vegetables, rice-cakes like muffins, wheaten leavened bread, sweetmeats, and sweet cakes—are to be seen at every turn; and of one or perhaps more of these every coolie will, when he can afford it, give himself a treat and vary his food, the main portion of which is rice, where it will grow, and in the high lands bread made from whatever grain the climate will produce.

In the lower part of Ssü-Ch'uan the roads are generally tracks paved with flags, 18 inches wide. This is sufficient for all purposes where the only wheeled conveyances are the barrows with the inevitable creaking wheel. Even these are entirely confined to the plains, never being used in the hill countries.

Goods are almost entirely carried by coolies, who, with a split bamboo over the shoulder, with a basket at each end, run along, in the hot weather naked to the waist, with huge broad-brimmed straw-hats on their heads, straw sandals on their feet, and generally a fan in their hands.

THE ASCENT TO SUNG-PAN-T'ING.

The road from Ch'eng-Tu to Sung-Pan-T'ing is full of interest, both from the natural beauty and magnificence of the scenery, as well as from the numerous historical associations of the country. Here is to be observed the civilised Chinaman in close contact with the mountaineer, who, now driven from the valleys, takes refuge on the steep hill-side or the wild fastnesses of the mountain gorges.

Most picturesque are the Mantzu villages perched on the summit of a crag, their gloomy stone walls with tiny holes for windows, and one high tower standing sentinel over the country.

Almost every village passed on the road has its tale: some marvels of a Buddhist saint, a thrilling story of battle or gentle song of love.

The road is now at the level of the stream—now scooped out of the solid rock or propped up for a yard or two by rickety-looking stakes from underneath—now winding up the side of a valley where a cascade leaps down to join the foaming torrent below; or rising over a spur from the mountains that bound it, the ground is carpeted with beautiful and variegated wild flowers.

Leaving Ch'eng-Tu by the north-west gate, the road for eight miles is across the beautiful and fertile plain. Here the whole country is a perfect network of canals and watercourses, and, as the

plain begins rising at the rate of 10 feet per mile, the streams are all rapid. The number of trees everywhere is very great all along the sides of the road, and between the fields are long rows of willows and a kind of beech; round all the houses are clusters. Now there is a line of fruit-trees, oranges or apricots; here a temple is inclosed by a wall with a number of fine yews inside; and, looking back from Kuan-Hsien, the plain has all the appearance of being densely wooded.

Kuan-Hsien is a busy place, situated at the embouchure of the river that here escapes from the mountains, and, by a number of ingenious irrigation works, is directed into the artificial channels by which the plain is watered. The dams for this purpose are, like all Chinese contrivances, remarkable for their simplicity; large boulders, about the size of a man's head, are collected and put into long cylindrical baskets of very open bamboo network; these cylindrical baskets are laid nearly horizontal, and thus the bund is formed.

The road ascends the left bank of the river between mountains that here rise about 3000 feet above the stream, their sides so steep as to become in places almost precipitous, and now and then there will be on either hand vertical cliffs 400 to 500 feet high; these are of bare rock, and in them the road is often regularly scooped out, sometimes without a parapet, and only just wide enough for laden mules; at others 6 or 7 feet broad, with a stone wall at the outer side.

Beyond Ouan-Chuan-Hsien is seen the first village of the Mantzu, or Barbarians, as the Chinese call them. The word Mantzu seems to be a sort of generic term applied by the Chinese generally to all the aborigines of this country, and many will include in it even the pure Tibetans, though the better informed know how to distinguish between the different tribes.

Perched like an eagle's eyrie right on the top of an almost inaccessible hill, or like wild birds' nests on the face of some perpendicular cliff, these curious villages are very remarkable features in the landscape. The houses are of stone—the lower part with narrow slits for windows like the loop-holes of a fort. The roofs are flat, and on part of these is generally erected a kind of shed.

There are altogether eighteen of these tribes spreading over the country from Yun-nan to the extreme north of Ssü-Ch'uan. Each tribe has its king—one of them a queen, and they live almost entirely by agriculture and cattle keeping. The king usually derives a considerable revenue from his lands, and every family in his kingdom has to send one man for six months to work on his

estate. In other cases he receives an annual amount of eggs, flour, or wheat from each household. He has absolute power over all his land, assigns certain portions of it to certain families, and if they displease him, or he has any reason for doing so, he displaces them at once and puts others in their stead—all the houses and farm-buildings passing to the new-comer.

Intermarriage goes on between the Chinese and the Mantzu women, but not between the Mantzu and the Chinese women. This is much the same as in Tibet, where the Chinese officials are never permitted to take their wives with them, even the ambassador at Lassa being no exception to this rule. The officials and soldiers, therefore, when in Tibet take to themselves Tibetan wives. The children thus become entirely Tibetan, and when the Chinese officials return to China they usually leave behind them their family. The Tibetans in this are wise in their own generation, for if they permitted the Chinese to bring with them their wives and raise Chinese families, the country would soon become altogether Chinese.

At Li-fan-Fu I visited a little Mantzu village, to which I had to climb by a path inaccessible for either mules or ponies, to a height of 2000 feet above the valley. I sat down in the village school and soon collected a few people around me, who were very willing to give me the little information they possessed.

The Mantzu of this place—or Irun, as they call themselves—are in reality semi-Chinese. They wear the plait, their writing is Chinese, and they all talk Chinese, though they have a language of their own.

The tribe to the west of Tsakoutin have again another language, though the two are very similar. These have also a writing of their own, which appears to be more or less alphabetical, and is from left to right.

The Mantzu here are something like Chinese in appearance. Their dress is the same, but they have good teeth; the Chinese, as a rule, have vile teeth, ill-formed and irregular, very yellow and covered with tartar.

The village I was in was a wretched place. I walked through the streets, which were about 3 feet wide between the high stone walls of the houses. The interiors of these were about as dirty and as dark as Chinese houses usually are.

It is not more than eighteen or twenty years since the Mantzu were driven from these valleys by the Chinese. Every town and village has some tale to tell of the fight with the Mantzu, and the

numerous ruins, which from their appearance cannot be very old, prove how recent were the conflicts in which they were destroyed.

Sometimes a Chinese village is to be seen built close to the ruins of an aboriginal one, and the advance of the Chinese is thus presented to the traveller's eye in a very striking manner.

Two other tribes—the Su-mu and the Ru-kan (or, as the people here call them, the White Mantzu and the Black Mantzu)—live up a river that debouches a little higher up. The Su-mu are always ruled over by a queen. When the Tatars were conquering the land, this tribe happened at that time to have a queen for sovereign, who gave the Tatars great assistance, and, as an honorary distinction, it was decreed by the conquerors that in the future the Su-mu should always be governed by a queen.

Leaving the main river, the road to Li-fan-fu strikes up a tributary, and the scenery changes. Instead of the magnificent verdure we had left, the mountains rise up almost precipitously, and, with the exception of a few blades of grass, are almost bare, standing like a long wall, almost unbroken even by a gully; at the bottom, if there should be a little flat ground, it is converted into fields of barley, divided by walls of loose stone, where a village with its flat roof only wanted a few tall straight poplar-trees to be a model of many a Persian hamlet lying in the valleys of the great Elburz: at a little distance the resemblance was remarkable, and at times I almost imagined myself nearer to the Atrek than the Yang-Tzü.

At Sung-Pan-T'ing the Mantzu people have been left behind, and we are fairly in the country of the Sifan. These are much more like Chinese, and are a very wild-looking people. Some of them wear hats of felt, in shape like the Welsh women's, and high felt riding-boots. They have generally very deep voices, and have not such a trivial look about the face. Their language is peculiar to hear; they roll their "R's" very much, unlike the Chinese, who, in many cases, cannot pronounce an "R." They have also a great many of the guttural "Kh," and some sounds almost impossible to catch. Their architecture is almost the same as Chinese, but they do not turn up the ends of their ridges and gables; indeed at a distance the houses look very Swiss. On the hill-sides the roofs are made of planks, laid anyhow, with big stones on them to prevent their being blown off—just as in Switzerland.

The plateau between Sung-Pan and Lung-Ngan is scarcely inhabited. Great droves of yaks feed on the rounded hills that here are covered with grass and brushwood, and where hardly a

tree is seen. Little traffic passes this way, and the very few inhabitants are altogether Sifan.

The plateau, as the summit is approached, is bare and dreary, especially when viewed in mist and rain. A few patches of snow were lying within 50 feet of the highest point of the western face, and the ridge was crossed at an altitude of 12,500 feet. The characteristics of the eastern slopes of this mountain are very unlike those of the west. Its climate appears much more damp. The growth of trees, flowers, ferns, and grass is so luxuriant as to become in appearance almost tropical. Great pine-forests clothe the northern faces of the mountain-sides, while the southern slopes are covered with rich green grass.

The descent is very rapid, and lower down the hills on both sides are densely wooded with trees of the richest green.

The Sifan here live only on the tops of the hills, for the Chinese have driven them from the valleys. Every opening has its tale of war and bloodshed, and the new villages and new houses springing up in the valleys show how recent has been the relentless advance of the Chinese.

Further on, azaleas 15 to 20 feet high, covered with masses of blossoms, contrasted with the brilliant hue of the wild peony, while the ground was covered with magnificent ferns and mosses. The road again plunged into gorges, whose cliffs, 500 feet high, shut out everything but a narrow streak of sky.

About 30 miles from Lung-Ngan-Fu, a road leads to the east into the province of Shensi.

Below this the silk-manufacture commences; mulberry-trees, spoiled of their leaves, surround the houses. The cocoons are put out in great flat baskets to dry in the sun, and the women sit spinning at the doors of their houses. Indian-corn is the chief crop and food of the inhabitants. This is now planted in the fields, from which already one harvest of opium has been gathered. Round the villages there is a little wheat and tobacco, and the graceful bamboo again shelters the houses. The limit of this seems to be, as in the other valley, about 6000 feet above the sea.

About 50 miles above Mien-Chou the river is large enough for navigation, and descending to the city with a rapidity quite unknown in land travel, we were again in the plain country. The quiet mountain villages were left behind, and here instead the towns were big and full of people; numbers of labourers in the fields, coolies on the roads, and traffic on the river. There was an appearance of wealth and prosperity, of life and activity, about the country that contrasted remarkably with the miserable poverty we had

left only a few hours before. Sitting in our inn in a noisy town I could hear all the going to and fro in the streets, itinerant vendors selling their wares and crying them out, and the constant chatter chatter of the coolies and people in the restaurant close by.

The city of Mien-Chou is a large, well-built and important place, protected from floods by very extensive well-built river-walls; the streets nice and clean, and free from smells. In the market great quantities of beautiful vegetables were displayed, cabbages as round as cannon-balls, very fine cucumbers, and splendid turnips and bringalls. Leaving Mien-Chou, everything showed that we had now struck a great high-road. Quantities of coolies going both ways, chairs, ponies, and numbers of tea-houses by the roadside, enlivened the scene.

The crops are chiefly Indian-corn, beans, and ground-nuts. Of the last the Chinese make oil, and they are almost as fond of eating them as they are of water-melon seeds, and at all the stalls by the roadside are little piles of some twenty or thirty, which can be bought for a cash or two. There is also a good deal of rice, a great number of melons are grown in the gardens, and quantities of vegetables. The want of rain had been very severely felt here; some of the rice-fields were quite dry, and the Indian-corn looked burnt up. The people were fasting, beating gongs, and burning incense-sticks, and the south gates of the cities were shut, in the hopes of propitiating the skies.

As Ch'êng-Tu is approached, the country is again entirely given over to rice cultivation—the Indian corn disappearing; and as we march westwards there is more and more water, until we again come to the streams running by the road-sides. At Ch'êng-Tu itself there was no want of water: but, being the capital of the province, a fast was ordered, and all the usual devout ceremonies were gone through whereby it was hoped that rain would be brought. The drought when I was there was becoming very serious, but I have never heard that it eventuated in a serious famine in this province, though, as we know, the neighbouring one of Shansi has been the scene of one of the most appalling calamities that were ever inflicted on a nation.

The road from Ch'êng-Tu to Ta-Chien-Lu traverses, roughly speaking, two sides of an equilateral triangle. There is, or used to be, a direct road, but it passes through a country much disturbed by fighting amongst or with the aborigines, and for centuries almost the circuitous route has been considered the great high-road to Tibet.

The plain country is soon left, and 50 miles from Ch'êng-Tu

the mountains that stretch from here to the Himalayas are first seen.

There was still in many parts a considerable scarcity of water. The south gates of the city were shut, and the fast proclaimed made it somewhat difficult to obtain food. But still there was here no real distress amongst the people.

The main body of the Min River—only known here as the Southern River—is crossed just beyond Ch'ung-Chou by a bridge which bears on its walls a tablet with the somewhat boastful inscription that it is the finest in Ssü-Ch'uan.

This bridge is 240 yards long and $9\frac{1}{2}$ wide, has 15 arches, and is really a very fine work.

Ya-Chou is a place of great importance, as it is the starting-point of all the commerce to Tibet, to which place tea and cotton are the chief exports.

The most remarkable trade of this place is its commerce in tea, vast quantities of which are sent from here through Tibet and up to the very gates of our own tea-gardens in India.

The tea for the Tibetans is merely the sweepings that would elsewhere be thrown away, the poor Chinese in Ya-Chou paying seven or eight times the cost of this for what they drink themselves. It is pressed into cakes about $\frac{1}{4}$ foot long \times 1 foot \times $\frac{1}{4}$ inches, each of which is wrapped in straw, called a pau, and weighs 24 lbs.

The average load for a coolie is about ten or eleven of these packets. I have seen some carrying eighteen—that is 432 lbs. Little boys are constantly seen with five or six pau (120 lbs.). These men wear a sort of frame-work on their backs, which, if the load is bulky, often comes right over the head and forms in rainy weather a protection from the wet.

A little further on in one of the valleys there are a considerable number of the celebrated insect trees of Ssü-Ch'uan. This is a tree on which is bred the insect that produces the white wax of Ssü-Ch'uan. These trees are in appearance like an orange, with a smaller leaf. They have a very small white flower that grows in large sprays, now (20th July) covered with masses of blossom, and the strong smell, which was not very sweet, filled the air. This tree is chiefly grown in the Ning-Yuan-Fu neighbourhood, and the eggs are thence transported towards the end of April to Kia-Ting-Fu, where they are placed on the wax-tree, which is something like a willow. Here the insect emerges from his eggs, and the branch of the tree on which he is placed is soon covered with a kind of white wax, secreted. It is this white wax that is so celebrated, and is one of the most valuable products of Ssü-Ch'uan.

Ta-Chien-Lu may now be considered as the boundary of China, for up to this point the people are governed directly by the Chinese ; but beyond this there are native chiefs who, subject to China, rule over the people. There is a native king resident here, his territory extends to Ho-K'ou.

Ta-Chien-Lu is situated in a small open valley at the foot of mountains, inclosing it on all sides except to the east. The brawling stream that divides the city into two parts is crossed by a wooden bridge, and a good many trees grow about the banks. The streets of the place are narrow and dirty, the shops inferior, and in them are all sorts of strange wild figures, some with matted hair, and others with long locks falling down their shoulders. They dress in a coarse kind of serge or cotton stuff, and wear high leathern boots. The women wear a good many ornaments, some are good-looking and all utterly unlike the Chinese in every way.

Both the women and the men wear great quantities of gold and silver ornaments, heavy earrings and brooches, in which are great lumps of very rubbishy turquoise and coral. They wear round their necks charm-boxes ; some of gold, others with very delicate filigree work in silver. These are to contain prayers.

At Ta-Chien-Lu and all through Tibet the Indian rupee is the current coin ; and only those who have gone through the weary process of cutting up and weighing out lumps of silver, disputing over the scale and asserting the quality of the metal, can appreciate the feelings of satisfaction at again being able to make purchases in coin.

These rupees come in thousands all through Tibet, Lassa, and on to the frontiers of China, where merchants eagerly buy them up, and by melting them down are able to gain a slight percentage. Curious it is, too, to see the wild-looking fellows as well as Chinamen fastening their coats with buttons on which is the image and superscription of Her Most Gracious Majesty. There is scarcely a regiment in our service whose buttons do not find their way into Tibet. The old clothing in India is, I suppose, sold, the buttons bought by Indian traders and carried across the Himalayas, whence they gradually work their way eastwards. Lower down, imitation 4-anna pieces are used. These must be made somewhere in England.

From Ta-Chien-Lu the road at once ascends to the great plateau. The ascent is not a severe one—a gradual rise up a valley amongst granite rocks, capped at the summit with bare crags of limestone.

On the road are great droves of yaks, with enormous horns and heads like bisons, huge bushy tails, and hair under their stomachs reaching to the ground.

On passing the crest of Cheh-Toh-Shan the great upland country is at once entered. Standing on the summit of the pass, stretched below us was a fine valley, closed in on both sides by gently-sloping round-topped hills, all covered with splendid grass. The richness of the pasture was something astonishing. The ground was yellow with buttercups, and the air laden with the perfume of wild flowers of every description. Wild currants and gooseberries, barberries, a sort of yew, and many other shrubs, grew in profusion.

By the side of a little tent some Tibetans were lying about; their fierce dogs tied up to pegs in the ground, and great herds of sheep and cattle grazing round them.

The road to Lithang is a succession of mountains, valleys, huge pine-forests, and open glades. We must hurry through them.

Just before reaching this city the mountain Shiehla is crossed at an altitude of 13,700 feet. From here gentle slopes lead down about 700 feet to the plain. This is 8 to 10 miles wide, and stretches out for many miles east and west. Opposite, a range of hills bounds the plain; behind it rises a magnificent range of mountains, stretching as far as eye can see to the east and west; snowy peak rising behind snowy peak—where, even at that great distance, vast fields of snow almost dazzle the eye as the sun shines on them.

A river winds through the centre of the valley, and numerous streams run down from the mountains on each side, and at this season of the year, when covered with luxuriant grass and wild flowers, one can hardly regret that the excessive cold prevents anything else from growing. No cereals of any kind nor potatoes can be raised. Just round the houses at Lithang a few half-starved cabbages and miserable turnips appear to be the only things that can be produced.

Lithang is a cheerless place, situated at an altitude of 12,500 feet. The people said that it rained here every afternoon in the summer, but that the mornings were generally fine.

Though there are only 1000 families in the place, there is in the city a Lamassery containing 3000 Lamas, and within 5 miles another not much smaller. This Lamassery is adorned with a gilded roof, which has cost a large sum of money, notwithstanding the miserable poverty of the place.

Its chief productions are gold, sheep, horses, and cattle.

There are 300 Tibetan soldiers and 98 Chinese soldiers scattered about the neighbourhood.

The natives said that Ta-So, the last mountain-pass between us

and Bathang, was a very bad medicine-mountain. The inconvenience caused by the rarefaction of the air at these great altitudes is attributed by them to subtle exhalations, and they always speak of a high mountain as a medicine-mountain. Before reaching this, the magnificent mountain of Nen-Da, 22,000 feet high, is passed.

Near the top of Ta-So we found ourselves in a little circular basin, about 100 yards in diameter, surrounded on all sides, except that by which we had come, by steep and ragged precipices 300 feet high. At the bottom was a little pond of clear water.

No opening was anywhere visible in the savage walls of rock, but up one side a desperately steep and rough zigzag led to the top. Just over the crest of the pass (15,600 feet) is a great basin 2 miles in diameter, and such a wild and savage scene I never before looked on—a very abomination of desolation. Great masses of bare rock rising all round; their tops perpendicular, torn and rent into every conceivable shape by the rigour of the climate. Long slopes of débris that had fallen from these were at the bottom; and scattered over the flat of the basin, great blocks of rock lay tumbled about in most awful confusion amongst the masses that cropped out from below the surface. Three or four small ponds formed in the hollows were the sources of the stream that, descending from the basin, plunged into another valley, and, falling rapidly, soon became a roaring torrent, dashing through mile after mile of dense pine-forest.

The stillness of this place was very remarkable. The air was so rarefied that I could hardly hear the horse's feet only a few yards off, and when quite out of hearing of these, as I walked on alone, the silence was most impressive.

The town of Bathang is quite new, having being destroyed a few years ago in a frightful series of earthquakes that, lasting over many weeks, devastated the whole neighbourhood.

The plain of Bathang only covers an area of a few square miles, producing barley, wheat and Indian-corn.

The climate is remarkably warm, although it is at an altitude of 8000 feet.

It is on a small river of about 25 yards wide, that five miles lower joins the Chin-Sha, there 170 to 200 yards wide.

Bathang contains 300 families residing in about 200 houses.

It is chiefly remarkable for its immorality and its Lamassery, containing 1300 Lamas, whose golden roof cost upwards of 1000*l*.

TO TALI-FU.

To insure our safety on the road to Atentze the chief magistrate of Bathang came with us to that town, accompanied by the native chief and a large retinue, which day by day increased in number, until on the 3rd of March we had 300 men with us.

Then, when we had reached the place where the great Lassa road branches off, on a high plateau in a storm of wind and sleet the somewhat exciting spectacle lay before us of an encampment of 300 Tibetans turned out by the Lamas to bar the road to the centre of Tibet.

The boundary between Yunnan and Bathang is crossed at the Tsa-leh mountains 14,500 feet above the sea. This is also the water-parting between the two rivers, the Lan-Ts'ang and Chin-Sha. The country gradually descends from this point, the scenery changes and the climate becomes warmer.

Atentze (10,000 feet) on the western slope of the mountains is a Chinese town, but the people are still thoroughly Tibetan, even the Chinese talking Tibetan better than their own language.

The prevalence of goitre in these districts is something appalling; some attribute it to the water, others to the salt, but, whatever the cause, two-thirds of the population have swellings on their throats, some of enormous size.

All the country between the two rivers is covered with forests, in which there many wild beasts—amongst others, wild oxen and monkeys were reported.

From Atentze the road again crosses to the Chin-Sha River and follows it for two or three days, when it, for a third time, crosses the ridge and descends to the city of Tali-Fu.

The country for many miles round this city still bears the traces of the Mahometan rebellion; ruined villages and terraced hill-sides, where now no crops are raised, attest the sparseness of the population. Ssü-Ch'uan is over-populated, and a very little Government assistance would enable the people to emigrate to this province. This, however, they cannot obtain, and it must be a long time before this beautiful and naturally wealthy country can again become a flourishing one.

Tali-Fu itself is now, with its ruined houses, a melancholy place, and its cheeriness was not lessened by the pitiless rain that descended in a continuous stream day and night for the few days of our stay.

For many days before reaching this city we had been almost always marching in heavy rain, and the valleys were now all

flooded—so much so that the rice crop was lost, and in Tali-Fu I saw myself the young rice, on which the ear had hardly formed, being sold in the streets as green fodder for animals.

TO T'ÈNG-YUEH.

From here we followed in the footsteps of Mr. Margary, and the expedition that was sent to inquire into the circumstances of his death. Wherever we went, and whoever it might be that spoke of Mr. Margary, he was always referred to in terms of almost affectionate regard, and, standing at the scene of his cruel murder, I could not but feel what a loss the country had sustained in that brilliant young officer, who, through sickness and the difficulties surrounding a pioneer in new and untravelled districts, had not only carried out with singular tact the delicate duties entrusted to him, but had also known how to portray in striking and vivid colours the many new scenes presented to his view, and to leave a faithful and lasting record of the strange peoples and countries through which he passed as a legacy to regretful countrymen.

I lifted my hat as the only tribute of respect I could pay to one whose memory will long be dear to the hearts, not only of those who knew him, but of all who value the noble qualities of uprightness, courage and determination.

The direct road from Yung-Ch'ang was pronounced impracticable, owing to the fact that it passes over a plain entirely depopulated by the plague that appears every year in June or July. In describing the symptoms to me, the people said that a lump like a boil, about the size of half a small walnut, suddenly appeared on almost any part of the body; there was absolutely no attendant pain, and twenty-four hours was the outside that a person could live after the appearance of this lump.

Boccaccio thus describes some of the symptoms of plague at Florence in 1348:—"Here there appeared certain tumours in the groin or under the arm-pits, some as big as a small apple, others as an egg. But they generally died the third day from the first appearance of the symptoms, without a fever or other bad circumstance attending."

From Defoe, also, may be gathered that the plague of London was somewhat similar; but he was not himself an eye-witness of this terrible calamity, nor does he anywhere give a distinct account of the symptoms.

Near Yung-Ch'ang, my informant said that during July, August, and September, more than 1000 people died of this complaint. A

traveller who had passed the stricken districts in July said there were scarcely any inhabitants left, and that the dead bodies were lying about unburied; he added that the disease had moved southwards, and was raging in another district.

Beyond Yung-Ch'ang is the valley of the Lu-Chiang, so unhealthy that no stranger can at any time sleep here (so they say) without getting fever. In the summer months it is quite impassable. Even the inhabitants leave it, and ascend to the mountains.

The miasma that rises is said to be a reddish mist; the ordinary white mist that I often saw hanging over the valleys in this neighbourhood is said to be harmless.

We were fortunate in the time of our passage, and the sun shone brightly as we crossed the curious suspension-bridge that spans the river. It is, in two spans of 73 and 52 yards; but for greater ease in tightening up the chains, the two are not in the same straight line. In construction each span is identical with that I have already described.

In rainy variable weather at no season of the year will any one attempt the passage of this valley; and Marco's words, "So unhealthy that no stranger can pass in the summer-time," were brought strongly to my mind.

At Man-Yün, or, as it is usually called, Manwyne, we were delayed for weather. This (end of October) was not the regular rainy season in which no traffic of any kind is ever thought of; but, nevertheless, three consecutive days and nights of heavy rain made the muleteers refuse to attempt the onward journey.

But little traffic was met with on the almost uninhabited country to Bhamo, where Mr. Cooper, himself "one of the most adventurous of travellers," knew well from experience how best to administer the hospitality to which he was prompted by his sympathetic and kindly heart.

Here coolies, mules, and ponies were left behind, and coal and iron swiftly bore us down the broad bosom of the Irrawaddy to home and civilisation.

The above Paper will appear *in extenso* in the 'Journal,' vol. xlvii.

The PRESIDENT said Capt. Gill had determined by an elaborate series of observations, which would appear in the 'Journal,' but which time had not permitted to be read, the altitudes of the various mountainous regions he had traversed. No previous traveller had done this; and their perfect scientific accuracy might be relied on, as his hypsometrical instruments had, since his return, been tested at the Kew Observatory. His work had been done from a pure love of Geography and Science, and entirely at his own expense.

2.—*On* LIEUTENANT WHEELER'S (*U.S. Engineers*) *Explorations in New Mexico*. By T. W. GOAD, Member of the Survey Party.

THE Government of the United States has, for many years, recognised the necessity of collecting data for the preparation of complete maps of their territories. The information required was to be obtained by astronomical, geodetic, topographical, and hydrographic surveys, together with observations in meteorology, geology, botany, and zoology.

From 1804, up to the present time, various Expeditions have been sent out, by the War Department, to explore regions west of the Mississippi. The results obtained were satisfactory, considering the imperfect instruments used. But it was not until 1871 that the War Department was able to organize and fit out an Expedition of a character not to be rivalled by any country in the world.

Congress, under whose supervision the survey is conducted, has a just appreciation of the materials gathered. Lieutenant George M. Wheeler, of the United States Engineers, who had conducted successfully reconnaissances in California, was ordered to Washington and placed in command. Quoting General Humphreys and Lieutenant Wheeler :—

“ The basis of this work is the collection and preparation of the data for a series of topographical Atlas Maps, upon a scale of 1 inch to 8 miles, of the territory of the United States west of the 100th meridian : each sheet representing an area of from 17,000 to 18,000 square miles, and so projected that the several sheets may be joined to comprise entire political or other divisions.”

For the preparation of each of these sheets that delineate more especially the mountain-forms ; astronomic, geodetic, topographic and meteorological observations are necessarily made. The operations in the several branches of the survey are conducted in pursuance of a systematic plan, under which an annual project in detail is submitted by the officer in charge to the chief of Engineers.

So far as possible, without detriment to the principal objects of the survey, examinations are made concerning the resources of the country in wood, water, and agricultural productions ; the influence of climate, the character of vegetation, the location and extent of precious and economic minerals, the routes of communication for rail and common roads ; the character, habits, and disposition toward settlers of the several Indian tribes ; the water-supply available for irrigation ; the season of rain- and snow-fall ; the condition of mining and other industries, &c.

During the years between 1867 and 1873 an area of 228,150 square miles has been surveyed in California, Arizona, Utah, Colorado, and New Mexico; since which time this area has been probably doubled. Labours in this field become exploration indeed; and hardship, fatigue, with now and then scarcity of supplies and danger from hostile Indians, fall to the lot of those who are chosen for the task; and when the history of explorations and surveys in the United States—past, present, and future—becomes a subject upon which more light is thrown, then will come a truer appreciation of what is comprehended by leaving the highways of the mountain, valley, and desert plain, to search out the physical details of almost inaccessible altitudes, or the extent and structure of arid plains and sandy deserts, stretching in endless configuration westward, from the Mississippi to the Pacific.

Four years ago I went to the United States as a civil engineer, and was successful in obtaining an appointment under Lieutenant Hoxie of the United States Engineers, whose uniform kindness in furthering my interests I can never forget. This is but characteristic of his brother officers and other Americans, who invariably treat Englishmen with great hospitality. It was my good fortune to be appointed to Lieutenant Wheeler's exploration, west of the 100th meridian, which please accept as my excuse for presenting myself before you.

As I cannot go into a complete history of the survey, I shall confine myself to the exploration in New Mexico during the season of 1877. The rendezvous-camp was at Fort Lyon, Colorado, where the members of our party were directed to report. These were

Lieutenant C. C. Morrison, *Executive Officer*.

Frank Maxson, *Topographer*.

T. W. Goad, *Meteorologist*.

Charles Davis, *Odometer Recorder*.

S. H. Elkins, *General Assistant*.

Three Mexican packers and one African cook.

A complete set of scientific instruments was furnished, together with all necessary books for a six months' expedition. Our transport consisted of twenty mules and one horse. Twelve mules were used to pack our thirty or forty days' rations for nine men, luggage, &c. (we were each allowed 25 lbs. weight and a roll of blankets to sleep in). All were well armed with rifles and revolvers.

The section of New Mexico to be surveyed was between the 105th and 108th meridian, and between the 33rd and 35th parallel, the approximate area of which would be 15,600 square miles. About

one-half of this country was mountainous, the rest being "mesas" and plains. Our route was from Fort Lyon across the Costilla Mountains into New Mexico, and down the Rio Grande to Fort Craig. From this initial point we traversed the area allotted to the party.

The distinct ranges occupied by the division were the Magdalena Mountains, San Mateo, Fra Cristobal Oscura, San Soledad, Sierra Blanca, del Sacramento, Capitan, Carrizo, Jicarilla, Gallinas. The mesas were those situated between the Oscura and Manzana Mountains, and the Gallinas and Rio Grande. The plains of the Jornada del Muerto, those between San Soledad and Sierra Blanca Mountains, and between the Gallinas and Oscura Mountains. The principal rivers in this section are the Rio Grande del Norte and Pecos. They drain a considerable extent of country. Creeks and springs may be found in the mountains, but water is very scarce in the plains.

The Magdalena Range is probably 30 miles long, the axis running in a north-westerly direction. Magdalena Peak has an altitude of over 10,500 feet above the level of the sea, and is an important triangulation station. Cattle have good grazing-grounds in the cañons, and delicious springs give abundance of water. Gold-mines are also worked, but up to the present time have not proved very remunerative.

The San Mateo Mountains cover an area of probably 400 square miles. The peak is one of great beauty, having a vertical face to the south, and deep cañons on the east and west sides.

The Fra Cristobal and Caballo Mountains are parallel and adjacent to the Rio Grande. Like their brethren, the Rocky Mountains, they are composed of metamorphic rock. Looking from the north, the profile of this mountain gives one the idea of a human face, the features of which were distinctly delineated. Mexicans trace the resemblance of this profile to that of a priest named Cristobal, who was murdered in this locality by the Indians. The sides being perpendicular rendered the ascent extremely dangerous, sometimes causing us to cling to the face of the rock over precipices 1500 feet deep. Even on this almost inaccessible point there were indications of Indian occupancy.

Passing eastward to the San Andreas and San Soledad ranges, we occupied Salinas Peak. This mountain is shaped like a sugar-loaf, with almost impenetrable woods and steep rock slides. The chief officer was able, although water was extremely scarce, to complete the topography of the range included in this atlas sheet.

The next mountains of importance are the Sierra Blanca and Sacramento. For grandeur of scenery the White Mountains sur-

pass anything I have seen in New Mexico. Generally the approach to the Rockies, as they are sometimes called, is a gradual up-grade; but in this instance the Sierra Blanca rises from the lowlands with precipitous sides, and forms a cone of great uniformity. The vertical height from the base to the apex of the cone is from 6000 to 7000 feet. From the summit a panorama of vast extent and great beauty lay before us. The salt basin, south of the Malpais, presented a strange appearance. Of pure white, it looked as if a heavy fall of snow had covered a large area of the country, and in that locality alone the powerful rays of the sun had been unable to penetrate the magic circle and melt it.

The Santa Fé Baldy Mountains, seen with the naked eye a distance of over 175 miles, the Organ Mountains, Mount Taylor, Cook's Peak, and an infinity of peaks too numerous to mention. The appellation of White Mountains is owing to their being constantly covered with snow. Belonging to this grand range, Nogal Peak can be recognised among all others, and takes a very important place in the System of Triangles extended through this country.

On the east side, cañons, replete with Nature's gifts, especially water (the want of which is so much felt in New Mexico), will offer some day great inducements to emigrants.

In contiguity with Sierra Blanca are the Sacramento Mountains, covering a large area, and having an equally rich share of resources. Sierra Capitan, a range of mountains forming the highest summit in this latitude, between the Atlantic and Eastern New Mexico, has an approximate length of 25 miles, altitude 10,000 feet. These granite rocks raise their peaks high in air, having fantastic shapes representing castles, steeples, pyramids, all mixed together in strange confusion, as though a convulsion of Nature had upheaved a monstrous city.

From their sombre appearance the Oscura, or Dark Mountains, derive their name. On the west side a vertical face of 5000 to 6000 feet rendered the ascent impossible, necessitating a journey to the east side.

Some years since, great excitement was occasioned by the finding of gold in the Jicarilla Mountains. The Apaches, who then had that reservation, were removed, and miners from all parts of the country flocked to this Placer Eldorado. However, owing to the expense of hauling water for the gold-washing, the miners have gradually departed, and what was once a large mining district is now comparatively deserted.

An ingenious Yankee has invented a fanning-machine, or, as he

calls it, "a dry washer," which obviates the necessity of water. The gulchs in these mountains show how hard men will work when gold is the objective point.

The Jicarillas, Carrizo, and Gallinas Mountains are not of very high altitudes; they are well timbered, and game is plentiful.

The Manzana Mountains, of which Mosco Peak is the most prominent, has been of great service in carrying the Triangulation to the south and east. The mesa country in this section was most uninviting. Water is scarce, grass poor, and the general appearance of everything dried up.

Jornada del Muerto (or Journey of Death), this appellation is given because of the numerous massacres that have occurred in that region. The Indians were excessively troublesome, and numbers of unfortunates have perished by their hands. At one time no water could be had between Toussaints' Ranch and Fort Seldon, a distance of 90 miles, but now a half-way ranche has been built obviating this difficulty.

On the Caballo and Fra Cristobal Mountains the Red-skins built their watch-towers, from whence they could see the approach of emigrants and surprise them.

Between the Sierra Blanca and Oscura Mountains is a lava-flow of over 75 miles in length, with an average breadth of 3 miles. The crater is at the north end, and rises about 50 feet above the flow. This Malpais, as the Mexicans call it, resembles a black river, widening and narrowing as the country undulates.

The rock is sharp and porous, causing many of our mules to lose their shoes and cut themselves. Fortunately for us, we were able to escape the trials endured a previous year by Lieutenant Morrison's party, who were obliged to travel over a somewhat similar country. He says—"The animals had almost no grass, and were without water three days. The shoes were torn from their feet by the sharp points of lava; leather ones were substituted; everything was done to save their hoofs, but without success. Two of the five died; the other three were nearly worthless for some time. One poor brute had his hoofs torn away until the bone protruded below. Another had his leg broken by breaking through the shell over a large lava-bubble and becoming wedged in the crack." This stretch of lava, owing to denudation, is somewhat higher than the surrounding country, is full of caverns, and has natural fortresses.

The lava-beds of Oregon, where the Modocs resisted the United States troops, are said to be of the same lithological formation. Serpents and reptiles abound. Game is also plentiful in and

around this so-called bad country. Several caves were visited by us, but the only one of importance was near Fort Stanton. This cave, like the others, was in a limestone formation, and proved of considerable length. Some persons at Fort Stanton asserted that no one had been to the end, although a distance of 5 miles was measured. The exploration was of a most uncomfortable nature, necessitating long crawls through narrow passages, obliging us to wade up to our waists in ice-cold water for hours. Stalactites and stalagmites, of immense size, reflected the faint light of our tallow-candles, and when we were in domes of 75 to 100 feet high, we might have imagined ourselves in a cathedral. The lake in this cave was said to contain eyeless fish, but none of our party were able to catch or see any. A thorough search was made for an exit: holes hardly large enough for the body to pass were investigated with great risk by all of us.

Of the numerous Pueblo and Spanish ruins visited, the Gran Quivira is the largest. It is situated in the plains between the Manzana and Gallinas Mountains. It is supposed that, in the year 1550, Cortez, in crossing the continent, left some of his followers located in this spot. These men, taking advantage of the superstitions of the Montezuma Indians, compelled them to build a city under their supervision. Eventually the Indians rebelled, killing their masters and destroying everything.

Tradition says treasure lies buried in the ruins. The walls of the principal church are still standing, from 40 to 50 feet high; the inside length is 127 feet, with a breadth of 35 feet. On the outside the walls from the top are slightly bevelled, the corners being well tied. At the base, these walls are $5\frac{1}{2}$ feet thick. The masonry might be called rubble, with the sandstone well dressed on the outside and beautifully plumbed. Coarse mortar fills the crevices. There is only one door, facing the city, and no windows seem to have been built for light. Timbers still show where the gallery was, and the ornamentation of the cross-beams is very artistic. Adjoining the church is the monastery, with the priests' cells and refectory. Due east of the church is the town; the main building of which had 800 to 900 rooms.

Dwellings of the Indians were easily recognisable, divided into much smaller compartments. All the walls of these places were unnecessarily thick. A fort of some pretensions to solidity was south of the town.

Now no water is near, although drains and dried-up springs indicate there having been formerly a plentiful supply.

The Indians told us that a river flowed underneath the church,

but we were unable to discover it. Innumerable fragments of pottery were found. The population might be estimated at between 3000 to 5000 inhabitants.

A certain class of Mexicans, called Penitents, are numerous. They are fanatics of the lowest order, resembling the Fakirs of India, save that they profess the Roman Catholic religion. During Passion-week they inflict upon themselves the most horrible tortures. They strip naked, beat themselves with branches of cactus, and walk on a road strewn with the same plant. Others, again, carry a cross of immense weight, frequently causing them to fall and be crushed under the load.

Pueblos, or Montezuma Indians, are a thrifty and hard-working people, interfering with none, and showing their neighbours—the Mexicans—examples of industry which they are too apathetic to follow. From time immemorial the habits of these Indians have been the same, and, strange to say, they have retained their manners and customs distinct from those of the Mexicans. Their religion embraces a little Catholicism, and the worship of their God, Montezuma. They have an idea that the said Montezuma will revisit them at some future day: therefore, in expectation of his advent, a fire is continually kept burning in their circular council-chamber.

The largest Pueblo in New Mexico is that of Tāos, where there are probably 500 or 600 Indians. The fields around the Pueblos are cultivated, and the natives seem to be fairly well off, judging from the quantity of cattle, sheep and goats they possess.

Apaches, Navajoes and Utes are the nomadic tribes of this territory. To the east may be found the Arapahoes, Commanches, Kiowas, Cherokees, &c. There are, I believe, four Indian Reservations in New Mexico—Fort Stanton, the Warm Springs, Fort Wingate, and Cimarron. The Mescarello Apaches occupy the country that lies in the Sierra Blanca and Sacramento Mountains. These Apaches are, without doubt, of the worst class: laziness, theft, and every other crime, can be attributed to them. Small of stature and thin, they present a miserable appearance. One redeeming trait is their riding, which could not be excelled in any country. Their eyes are deep-set, and have an expression of fiendish malice uncomfortable to encounter. With red and yellow paint bedaubed on their faces, they come into the Agency with wild gesticulations, whooping and yelling like maniacs. A Government Agent is deputed to supply them with blankets, cooking-utensils, beef, and many other things, which, to my own personal knowledge, are wasted. It is not easy to account for the want of thrift of these red men. Their

Reservation abounds with game, bear, deer, wild turkey, &c. The land is also rich for agricultural purposes; so their continued depredations in Texas and elsewhere seem hardly to admit of excuse. The Warm Spring Apaches are but the brethren of the Mescaleros, and many tales of cruelties and massacres are recorded against them. However, during the whole of our sojourn in the territory we were, fortunately, unmolested, and never lost an animal.

The Navajoes are a far superior race, and, as Lieut. Morrison says, "there is possibly no Indian in the plains as intelligent as these Navajoes. Of straight, lithe figures, wonderfully square shoulders, the average height, quick of movements, with bright, intelligent, rather pointed faces, they are easily distinguished when mingling with other Indians; while still having the characteristics of the nomadic tribes, they are better able to support themselves. Even now they raise corn and bread, and have very large herds of sheep and horses; they have many four-horned sheep. The head of an old buck presents a strange appearance. In addition to the heavy horns turning up, there is still a second pair, equally large, which turns down and back.

"The squaw's process of making blankets is a very tedious affair. Between two upright poles are three horizontal, two of these placed apart, a little more than the length of the blanket, which runs vertically from one to the other; the warp-threads are stretched; then those of the woof are put in, one at a time, by hand; a narrow, thin board is put in after each of them, and they are hammered down by striking the board with a club, which they handle so skilfully as to rarely break a thread. Some of the yarn is furnished by the Government, but the best white yarn they make from the wool of their sheep, and the finest red, by picking an English cloth and spinning the yarn. These blankets are wonderfully warm, and are a perfect protection against rain."

The Utes of the Cimarron Agency are, comparatively speaking, industrious, for they seek a livelihood by hunting the buffalo on the Llano Estacado (or Staked Plains of Texas), tanning the hides skilfully and ornamentally, which they trade with the whites. Our two principal ration stations were Fort Stanton and Fort Craig. Fort Stanton is considered a very desirable post by United States officers, and the appearance of the adobe, or mud-houses, is more prepossessing than those of Fort Craig. Of Mexican towns passed through by us, Santa Fé was the most important. Second to it is Albuquerque, on the left bank of the Rio Grande del Norte. It was formerly a garrison town, but now there are few remains of its defences.

The surrounding country yields a considerable amount of grain, and the vineyards and orchards are most productive. This may be owing to white colonisation. Following the Rio Grande as far as Old Mexico, we find on its banks Mexican and Pueblo villages. This rapid river, of great capacity, is not used for purposes of irrigation as much as it might be. At some future date this section may become a vineyard. It might be practicable to turn the waters of the Rio Grande into the desert of the Jornada del Muerto, making a grazing-ground with rich gramma grass of over 4500 square miles. But for the want of water, New Mexico would surpass Texas as a cattle-raising country.

A class of individuals of whom I have not spoken are the Desperadoes. These men are the scourge of society. Though arrant cowards, they are to be feared, as they shoot men without warning. They live by horse-stealing, and pride themselves on having killed their twenty or thirty victims. They infest, of course, all drinking-saloons, and to strangers are insolent, for the purpose of having, if remonstrated with, an excuse to shoot. This lawlessness is carried to a fearful excess in some localities, and the sheriffs are unable, for want of authorised aid, to suppress the rioters. Fandangoes are danced with revolver accompaniments. An anecdote told me in the West will bear repeating: "A well-to-do farmer went into a saloon for a glass of lager-beer. A desperado, thirsting for blood and armed with a six-shooter, accosted him in a brutal manner: 'Have a drink?' The farmer refused; whereupon the villain deliberately took aim, and would have fired, but for the presence of mind displayed by the countryman, who, looking over the desperado's shoulder at an imaginary friend, said, 'Don't fire, Joe, he's only joking!' This caused the coward to look round, when the farmer instantly drew his pistol and shot the would-be assassin dead on the spot." Another ruffian was heard to express the following sentiment: "I would not have a fellow walking around this world whose looks I did not like, so I shot him in the back!" This class of men, I am happy to say, is disappearing as civilisation, with its checks, advances.

The maximum heat was 102° Fahr. in the shade, and between 120° and 130° in the sun. In November our minimum recorded 29° below freezing, although the previous year it was 16° below zero. New Mexico has a rainy season in July and August. Thunderstorms are frequent during these months, and the hailstones are of large size. Wind storms on the plains are severe, and we encountered several hurricanes.

I recall one rain-storm in the San Andreas Mountains which

very nearly swept away the whole camp; and although it lasted but a short time, the dry drain by the side of which we were camped became a roaring torrent, overflowing the sides and necessitating the hurried evacuation of the cook's premises. Nimbus clouds are not often seen, except in the rainy season. Cirrus, stratus, and cumulus clouds sometimes appeared in the morning and evening, but were soon dispersed during the heat of the day. Little or no dew falls, except in the mountains, during spring and autumn. A heavy rainfall in what may be termed the monsoon might be estimated at 2 to 4 inches an hour.

The cañon of the Rio Grande, below Costilla, is of peculiar interest, because it differs in most respects from other cañons; that is, instead of being worn away by the action of the water alone, it was probably commenced by volcanic action. The sides are of trap-rock, and, although the cañon itself is very narrow, its depth is probably 1000 feet. The river at this point has a great fall, and rushes along with a velocity of 10 miles an hour. As synchronous observations for altitude were to be taken, it devolved upon me to descend to the water's edge, and save my neck if I could. In the Mesa country cañons abound; and where they are, the country necessarily must be barren and sterile, as the water is carried off far below the reach of animal or vegetable life. The climate of New Mexico is delightful, for at no season are you deprived of sleep by excessive heat, nor does the dry cold affect the body. In summer, during the day, the heat may be very great; but as soon as the sun sets a delightful cool breeze springs up and at once soothes the over-heated blood. Consumption is unknown among the people of New Mexico, and if the Mexicans were a little more cleanly their curse—the small-pox—would disappear. Small-pox in New Mexico is not of that virulent description known in Europe; but, nevertheless, Mexican and Indian children die by the hundred from want of common precaution. It is a strange thing that if an animal die on the road, and is not devoured by coyotes or wolves, the flesh will become dry and not decompose in the usual manner. This may be attributable to the dryness of the air, which absorbs all moisture. The atmosphere being so clear, objects at great distances appear close at hand, and one unaccustomed to this phenomenon would frequently be led to undertake journeys of five times the supposed distance. A topographer in this country has to be a man educated to estimate these distances, and sometimes it was really wonderful how Mr. Maxson could be so accurate. Mirages are by no means rare, and we saw some of the most remarkable kind. The health of our party was good, except when the only

water that could be obtained was strongly impregnated with alkali. From May to December we had been constantly at work, during which time we traversed a distance of over 3600 miles on mule-back, occupying fourteen Triangulation Stations and numerous minor points. Our lowest camp altitude was at the Malpais Spring, the highest being on Sierra Blanca. I cannot give these elevations and profiles; having no data in England of the survey, my Paper has necessarily been superficial. It is my intention to return shortly to the United States, when I hope once more to visit unknown territories, and contribute some little share to the good work of the Royal Geographical Society, now that I have the honour of being a Fellow.*

The PRESIDENT, in complimenting the author of the Paper for the interesting account he had given of the topographical survey which the Government of the United States had caused to be made, expressed a hope that the American Minister, who was present, would address a few words to the Meeting.

The UNITED STATES' MINISTER thanked the President for his kind appreciation of the geographical work of the Survey. For himself, he must confess his ignorance of the country described by Mr. Goad. The United States' territory was somewhat large, and it could hardly be expected that any one could have sufficient knowledge of every part of it to be able to speak on the subject. At the same time, he would assure the Society it would have afforded him great pleasure to have given any information he possessed regarding the region treated of in the Paper.

Sir HENRY RAWLINSON said he had no personal information to give with regard to the country traversed by Capt. Gill, but he thought it would be a great

* The following is a list showing numerically the principal observations made during the field season of 1877:—

Number of azimuths measured	1
„ „ sextant latitude stations occupied, with local names ..	3
„ „ main triangulation „ ..	14
„ „ secondary triangulation stations occupied	2
„ „ „ „ „ „	58
„ „ „ „ „ „	666
„ „ meander	2993
„ „ monuments built	43
„ „ variations of needle taken	102
„ „ miles meandered	2869
„ „ miles travelled and not meandered	733
„ „ camps made during season	146
„ „ cistern barometer stations occupied	278
„ „ aneroid stations occupied	1828
Lowest altitude noted (approx.)	3590
Number and locality of mining camps visited	1
„ „ of days actively employed on the march	172
„ „ „ „ in camp	21
„ „ of sets of sextant time observations	19
„ „ „ „ latitude determinations	3
„ „ of stations of hourly barometer observations	4
„ „ of pointings on triangulation and topographical observations	6590
„ „ of rivers and creeks gauged	1

pity if such an interesting Paper did not elicit some discussion. In many respects Capt. Gill's Paper was one of the most remarkable that had ever been read before the Society. Capt. Gill had had the great advantage of a scientific training in the Royal Engineers; but, having inherited a fortune, instead of giving himself up to fast living in London, he had devoted himself to geographical research. This was not the first occasion when Capt. Gill had done good service to Geography. A few years ago he accompanied Col. Baker to the frontier debatable land between Persia and Russia, a region which very possibly, in a not remote future, would become of the greatest political interest. He assisted Col. Baker in mapping all that region, and brought back most valuable scientific information. He had never yet received the credit which was due to him for that journey, and therefore, *en passant*, he (Sir H. Rawlinson), on behalf of the Royal Geographical Society, tendered him their best thanks for what he had done on that occasion. Subsequently Capt. Gill proceeded to China, and was enabled, by his possession of ample means, to set out from Shanghai and travel right through China into Burmah. The Royal Geographical Society had always declared that they did not pursue Geography as a mere abstract or dilettante science, but also looked to practical effects. They considered Geography, indeed, in its relation to the progress and advancement of civilisation and the spread of commerce, as well as in regard to its scientific value. The practical point in Capt. Gill's journey was that he proceeded along one of the great trade routes of the world, which had always attracted much attention, and probably in the future would attract still more—the trade route from Sze-chuen (Ssü-Ch'uan) to Lassa, and through Tibet to India. One of the most interesting points alluded to in the Paper was the route from Bathang across the frontier to Lassa, and he wished to know what Capt. Gill's opinion was as to the possibility of opening out that route. The Che-foo Convention provided for such a possibility, and over and over again it had been in contemplation to send an expedition along it, either from India to China, or from China to India. That was really one of the most important geographical problems still remaining unsolved in Central Asia, and one to which great interest was attached, not only by geographers but by politicians and merchants. Many parts of Capt. Gill's route were entirely new, such as the détour he made to the mountains from Ch'eng-Tu northward, and any details he could give with regard to the tribes in those mountains would be of exceeding interest. He also thought the route taken from Bathang to Tali-Fu was new. The only traveller who had previously attempted that line was Mr. Cooper, but he was unable to proceed more than a very short distance. It would also be very desirable if Capt. Gill would tell them a little about the products and capabilities of Sze-chuen. Bishop Chauveau used to send most favourable accounts of the country and of the possibility of carrying on a very considerable import and export trade there. Capt. Gill must have had excellent opportunities of making himself acquainted with the capabilities of Sze-chuen, and any information he could give on that subject would be of great interest.

Dr. LOCKHART said Capt. Gill was one of only four Europeans who had ever passed from China into India, and the greater portion of the route he had followed had never been gone over previously. He was to be congratulated upon his safe return to England, and he deserved great credit for the arduous journey which he had performed with so much vigour, earnestness, and energy. He hoped that the results of his travels would shortly be published. The great province of Sze-chuen (Ssü-Ch'uan) was extremely well watered. It was called the Province of the Four Streams, because the Yang-tsze-kiang there divided itself into four large streams. It was one of the most fertile gardens of the country. As Yunnan was remarkable for its minerals, so Sze-chuen was remarkable for the variety of its products—grain,

drugs, and rhubarb, the latter being sent to all parts of China, and exported to Europe. It was one of the great agricultural districts of China, though of late years, during the Rebellion, a great number of the population had been destroyed. Sze-chuen had doubtless a prosperous future before it, being beautifully situated at the foot of the Himalaya mountains, and watered by the Yang-tsze-kiang. The branch of the Yang-tsze-kiang at its southern boundary was called the Gold Sand River, and no doubt a great deal of gold could be derived from its bed, though hitherto, in consequence of the lack of scientific miners, not much had been produced. The remainder of Capt. Gill's route was intensely interesting, in consequence of what happened to Mr. Margary at Manwyne. Every one must lament that so enterprising and intrepid an officer as Mr. Margary should at the last moment, when he was on the very verge of victory, have been slaughtered by the wild tribes living on the frontiers of Yunnan. His own opinion was, that Mr. Margary's murderers were incited to commit the crime by the Government of China. He believed that the Peking Government sent orders that Mr. Margary must not be allowed to pass through China to India, and he still retained that belief, though the Chinese Government had denied all complicity in the murder. He regarded the Miau-tsze (Miaotzu), of whom Capt. Gill had spoken, as the aboriginal inhabitants of China. In former Sessions he himself had exhibited engravings representing those tribes, and his impression was that they had been driven out of the plains into the mountainous districts of Kweichow, Yunnan, and Sze-chuen, where they now had their own system of government and their own laws, which prevented their mixing with the Chinese populations around them. He supposed the Li-fans to whom Capt. Gill had alluded were Tibetans. It was the name often given to the Tibetan tribes inhabiting the frontier land between China and Tibet. He heartily congratulated Capt. Gill on his return to England, and on the vigorous manner in which he had conducted his journey from China to the plains of India.

Sir WALTER MEDHURST quite agreed with Sir H. Rawlinson and Dr. Lockhart in expressing their gratitude to Capt. Gill for his interesting account of his travels. What they had heard only made them wish to learn more of so interesting a country. A great deal that was nonsensical had been said in England about the opium trade, as well as a great deal that was true, and he would be glad to know from Capt. Gill what the result of his observations was as to the production and consumption of the drug by the Chinese. He was pleased to hear the testimony which Capt. Gill had borne to the good qualities of the Chinese. Englishmen were too apt to regard them as a degraded and immoral people. It would be interesting to hear any information which Capt. Gill could give as to the prevalence of infanticide.

Capt. GILL thanked Sir Henry Rawlinson and Dr. Lockhart for the kind way in which they had spoken of his travels. He did not know that he had done anything deserving of such praise. He was very fond of travelling; and if he could render any service to science he was most happy to do so. There were two roads to Lassa, one from Ta-Chien-Lu northward, to a place called Chiamdo, and then straight to Lassa. It was reported to him as being a very fair road, and no doubt it was, as it kept on the high plateau. Traders used it to a great extent, but there were no Chinese officials there. The other road struck off to the west from Jang-Ba. He did not think there were any very great difficulties to be encountered there. There could be no doubt that if a tea-trade could be opened up from Tibet to India, it would be of great advantage. At present, tea was carried on the backs of coolies from Ya-Chou over the mountains, some months being occupied in the journey. Of course that made the tea tolerably expensive by the time it reached the consumer. If a trade could be opened up between India and Lassa, even

the sweepings of the floors would be eagerly used by the people, who were not averse to trading, and were a very pleasant people to be among—barring their excessive dirtiness. The Lamas, however, were very objectionable. They were very powerful and very bigoted. Nearly the whole of the country was mortgaged to them, and they lived together in large bodies, and were exceedingly immoral. A traveller in Tibet would meet with no opposition, but the Lamas would exert their influence with the people to desert the country, and so leave him without supplies. As he had stated in his Paper, on the road to Bathang a lot of people turned out to oppose him, but it was very likely that they knew he was not going to Lassa. If he had been going, it is quite possible that they would not have made such a demonstration. He could not conceive of any country more rich in agricultural products than Ssü-Ch'uan. Wherever the slope was not more than 30°, the land was cultivated. Where it was steeper than that, a man could not stand to cultivate it. Rice was grown in the low valleys; higher up, Indian corn, which was probably the greatest crop in the country; and still higher up, wheat and barley. The people were very pleasant to travel amongst, and he never had an uncivil word from them during the whole time he was in China. With regard to the Miaotzu and Mantzu, there were eighteen tribes of those people. He did not know anything about the Miaotzu who lived in the Province of Kwei-Chou, but there was no doubt the Mantzu were Tibetans. He had compared several of their words with those he found in a Tibetan grammar, and there was a great similarity. In the lower part of Ssü-Ch'uan, about half the country was given up to opium, in May, when he was there; but when he arrived at the other part of the province, the opium had been gathered, so that he could not give any opinion as to the quantity of land devoted to its cultivation there. In Yunnan, also, he saw no opium growing, as it was too late in the year. It was smoked almost universally. There was a Chinese proverb that an opium-pipe was to be found in every house in the Province of Kwei-Chou, but one in every room in the Province of Yunnan. He thought that was true, and it tended to make travelling rather tedious, because it was impossible to get the men to start early in the morning. With regard to immorality, his impression was that the Chinese were a very moral people. He had never seen nor heard of any immorality amongst them. During the whole time he was there he did not see a drunken man. The coolies sometimes drank spirits at the tea-houses, but only about a thimbleful, and the bottles they carried would not hold more than two ordinary sherry glasses. He did not believe such a thing as intemperance was known in that part of China.

The PRESIDENT said he was afraid the hour was now too late for them to enter any further into the interesting questions which had been suggested by the Papers. In justice to Capt. Gill, it should be stated that he had read only a portion of his Paper; but both his and Mr. Goad's would be printed *in extenso*, so that members would hereafter be able to consult them. With regard to the trade between Tibet and India, exertions were being made by some great capitalists to open up communication between Tibet and the Assam tea-country. In conclusion, he begged to move a cordial vote of thanks to Capt. Gill and Mr. Goad for the Papers which they had read.

Eleventh Meeting, 13th May, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*George East, Esq.*; *Alfred Edward Hippius, Esq.* (Deputy Commissioner, Chinese Customs Service); *Charles Eugene Lienhardt, Esq.*; *Colin Mackenzie, Esq.*; *Percy Hugh Seymour Montgomery, Esq.*; *Stanton Wise, Esq., M.D.*

DONATIONS TO LIBRARY, APRIL 9TH TO MAY 13TH, 1878.—*Tableaux historiques de l'Asie, par J. Klaproth, with Atlas, 1826 (Sir Walter C. Trevelyan, Bart.)*. Further correspondence respecting the affairs of South Africa, 1878 (*Lord Arthur Russell*). *Quali sia il limite fra le Alpi e gli Appennini, di Pietro Canepa, 1878 (Author)*. The languages of Mosambique, from the MSS. of Dr. W. Peters, by W. H. I. Bleek, 1856; a Sketch of the Geology of a portion of Quang-Tung Province, by T. W. Kingsmill; and Great North Atlantic Telegraph route, 1866 (*Kenneth Murchison, Esq.*). Records of the Geological Survey of India, XI. part 1 (*The Government, per Dr. Oldham*). Account of the Godavery district, Madras, by H. Morris, 1878 (*Author*). The Madura Country, by J. H. Nelson, 1868 (*H. M. Secretary of State for India*). On the supply of nitrate of soda and guano from Peru, by G. Peacock, 1878 (*Author*). The Straits of Belle Isle, by P. Fortin, 1877, and Report on establishing a submarine telegraphic system for the river and gulf of St. Lawrence, 1876 (*The Canadian Government*). Report on seizure by Abyssinians of the Geological reconnaissance Expedition, by L. H. Mitchell, 1878 (*General Stone*). From Europe to Paraguay and Matto Grosso, by M. G. Mulhall, 1877 (*Authoress, per Mr. Stanford*). General Report on the Marine Survey of India, 1876-77, by A. Dundas Taylor, 1878 (*D. Sunder, Esq., Chief Clerk of Marine Survey Department, Calcutta*). Victoria, Indexes to Patents, 1878, by R. Gibbs, and Parts vii and ix of Statistical Register for 1876 (*Registrar General of Victoria*). And the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM, FROM APRIL 8th TO MAY 13th, 1878.—Egypt, Provinces of the Equator; Map of the Nile from Duffli to Magungo, according to a reconnaissance made July 1877 by Col. Mason, Bey; Map of Lake Albert, according to a reconnaissance made by Col. Mason, Bey, June 1877. Mitchell's Expedition Map of the region of country between Massowah and Gurra (*General Stone, Chief of the General Staff, Egyptian Army*). District of

New Mexico (*T. W. Goad*). Diocesan Map of the Church of England in Newfoundland, by the Rev. J. J. Curling (*the Author*). The Victoria Nyanza Mission (*R. N. Cust, Esq.*). Plan of the Southern portion of the Province of South Australia, divided into Counties and Hundreds, 18 sheets (*The Agent-General for South Australia*). Admiralty Charts, 13 sheets (*The Hydrographer*). United States Charts, 1 sheet (*Commodore Wyman, U.S.N., United States Hydrographer*).

Before proceeding to the business of the evening, the PRESIDENT alluded to the melancholy intelligence, which had arrived since the last Meeting, of the death of Mr. T. T. Cooper, whose name was familiar to the members of the Society. Mr. Cooper had long been connected with efforts for the exploration of Western China, and the routes across the frontier into India. The circumstances of his death were rather obscure. He appeared to have been killed in some affray with his own guard, and a Sepoy seemed to have fallen a victim with him. Although not a scientific geographer, he was a very ardent explorer, his object being to open up new routes for commerce through regions which had never before been penetrated by European travellers. Men of this class were not so frequently met with that they could be permitted to pass away without a few kind words to their memory.

The Paper to be read was by Captain H. Trotter, on the Geographical results of Sir Douglas Forsyth's important expedition to Kashgar. Under the orders of Sir Douglas Forsyth, Captain Trotter penetrated to those elevated regions north-west of Kashgar, of which previously very little was known, and being a man of high scientific attainments, he was able to make observations of great geographical value. One part of his Paper would describe the lofty plateau and passes of the Pamir, poetically termed by the Persians, with a touch of Oriental imagery, the "Roof of the World." When a man reached to 20,000 feet above the level of the sea, a height attained in some portions of the journey, he must get what was popularly called a bird's-eye view in the fullest sense of the word.

Captain H. TROTTER, R.E., Deputy Superintendent of the Great Trigonometrical Survey, then read his Paper:—

*On the Geographical Results of the Mission to Kashgar, under Sir
T. Douglas Forsyth, in 1873-4.*

THE Mission left India in the summer of 1873, and was absent rather more than a year. The author stated that a considerable amount of literature already existed on the subject of the Expedition; for, besides very voluminous reports to Government from the seven European officers, of whom the Mission was composed, two books on the same subject had been published in England, viz., the 'Roof of the World,' by Colonel Gordon, and 'Kashmir and Kashgar,' by Dr. H. W. Bellew. The present Paper was taken in great part from Captain Trotter's own section of the official Reports, of which not many copies were printed, and very few made available to the general public.

The Paper will be printed entire, with a Map, in the 'Journal,' vol. xlviii.

The PRESIDENT expressed his great regret at the absence on that occasion of Sir Henry Rawlinson and Colonel Yule, our two greatest authorities on Central Asia. Sir Henry, he was sorry to say, was kept away by indisposition, otherwise he was sure he would not have failed to be present when a subject was discussed in which he took so deep an interest. The Meeting had, however, the advantage of the presence of Sir Douglas Forsyth, who undoubtedly was a great authority on this subject, as he was the head of the Mission to which Captain Trotter was attached. The region which had been described was one of the most interesting in Central Asia. It was the great source from which so many successive waves of population had flowed towards the West. Why such should have been the case was one of those problems which had never been satisfactorily solved, but all tradition seemed to point to the great central plateau of Asia as the home from which the nations of Western Europe originally came. That fact alone gave considerable interest to the region. Sir Brooke Robertson, who had long been in China, was also present, and as the attention of our diplomatic staff in that country had naturally been directed to the operations of the Chinese Government, which had recently, by one of the most extraordinary marches and campaigns in its history, recovered possession of Eastern Turkistan, lost to them by revolt some twelve years ago. This afforded a remarkable instance of the tenacity and perseverance with which that great people held on to any object that they had once attempted. A great many years ago, when the question of an alliance with Kashgar was under consideration, he (Sir Rutherford) expressed his conviction that the Chinese Government would never fail, sooner or later, to make such vigorous efforts as would probably recover the lost province. It had simply been a penal settlement, but their national pride and doggedness of disposition would lead them to recover it. Yakoob Beg had now passed away, and nearly the whole Mussulman population had been exterminated for the second time, which was the only way in which these Eastern races understood the conquest of a country. They had done the same in Yunnan and the South-Western Provinces. A great deal had been heard about Bulgarian atrocities, but really those Eastern races had no other idea of making war but destroying their enemies. They had done so for two thousand years, and, to all appearances, would continue to do so. The campaign, however, was a very strange one. Finding that their commissariat was insufficient, and that there was no food for them, the army from China turned their swords into ploughshares for a season and grew a crop of rice. Then they moved on again. This was a new mode of warfare. It required that time should be no object, and that there should be men in abundance. Although he did not suppose that the days of Yengis Khan or Timour the Tartar would return, there was no doubt that the Chinese Government could send two or three million men across the whole breadth of the continent, if they chose to take it into their heads to do so. These, however, were rather speculative matters. What the Meeting chiefly wished to know was whether there was any prospect of establishing peaceable commercial relations across these great and formidable passes; and no doubt Sir Douglas Forsyth would be able to say what hope there was of ever realising Mr. Shaw's dream of a large and beneficial intercourse between India and Eastern Turkestan.

SIR DOUGLAS FORSYTH said he wished to add his mite of applause to that which had been given to his friend Captain Trotter, and to congratulate him on being the Gold Medallist for the year. He knew how much he desired this distinction, and he could testify how thoroughly it had been deserved.

The Society had honoured itself by honouring Captain Trotter and enrolling him in their list of medallists. When Lord Northbrook determined on sending the Mission to Kashgar, he very wisely decided not to leave the scientific results to haphazard, and therefore appointed two professional, scientific men to take advantage of the opportunity to collect all the information they could regarding the interesting region to be passed through. One of these officers was Captain Trotter. He (Sir D. Forsyth) had witnessed the patience, endurance, and marvellous care with which he had pursued his investigations, and therefore he most heartily joined in congratulating him on having achieved such glorious results. A few days ago a Paper was read by Dr. Marcet at the Royal Society on the difficulty of respiration at an elevation of 13,000 feet. Captain Trotter had been at an elevation of 19,000 feet, not only for one, but for several days, and had worked his instruments in a most laborious way. The best way he knew to convey an idea of a person's feelings at such a height was to ask ladies who were not good sailors to remember their sensations when crossing the Channel; yet, in spite of these difficulties, Captain Trotter made most accurate observations, and recorded them in the most accurate manner. It might seem an extraordinary thing to people at home to learn that the cold was so intense in those parts; but from September till April the thermometer at night never rose above freezing-point, and for weeks together it was below zero. For the greater part of that time the Mission lived in tents, not in comfortable houses. He recollected one morning, the cold being very severe, calling out to Captain Trotter, who was in the next tent, to know what the thermometer had registered during the night. The answer that came back was "25° below zero." On one occasion Colonel Gordon, when out shooting, omitted to keep his gloves on, and on touching his rifle-barrel his hand became one mass of blisters. Captain Trotter, however, worked his instruments night and day with the utmost care, notwithstanding all the difficulties he had to contend with. On Dr. Stoliczka the cold told with fatal effect. He was a most remarkable man. He was originally appointed to the Expedition on account of his attainments as a geologist, botanist, and naturalist, but he was well versed in the kindred science of geography. On every subject he seemed to be brimful of information, while he had that charm of modesty and engaging manner in imparting his knowledge which made it quite a treat to be in his society. He could not, however, stand the cold on the heights. He struggled through to the Sir-i-Kol and over the Pamir, and on his return reached almost the last pass, where he succumbed, and he was buried at Leh. The Pamir was the great line of the trade-routes between China and Persia in the very earliest days of history. The exact route which was followed was still doubtful, but it must either have gone from Yarkand to the valley of the Oxus, or from Kashgar right across Khokan to Indajan. Sir Henry Rawlinson would not hear of this latter route being the true one, but if he had been on the spot he would have allowed that there was a great deal to be said in its favour. The President had spoken of the Pamir as being the "Roof of the World," as though it was the highest part. That, no doubt, was the popular idea, but the Karakorum Mountains were much higher; and while the passes over the Pamir were only from 13,000 to 14,000 feet, those over the Karakorum were from 19,000 to 20,000 feet. For centuries this region was part of the empire ruled over by a long line of Scythian kings. Herodotus spoke of the Messagetæ, the Issedones, the Sacæ, and other tribes as inhabiting the country, and the borders of Vandals, Goths, and Huns had their origin there. Dr. Bellew, who was the medical officer to the expedition, was a wonderful linguist, who was perpetually studying the languages and examining all the manuscripts he could find in those parts. Undoubtedly the Hungarians were of opinion that they came from there. Vambéry once told him that the object of his journey to

Bokhara was to ascertain the origin of his own race, though probably there was a political object as well. One day, when he (Sir D. Forsyth) was at Yangi-Hissar, while Captain Trotter and his party were crossing the Pamir, he heard that a Magyar Pole had crossed from the Russian frontier to Kashgar, and was asking eagerly for the English Mission. When the meeting took place, he said, "Oh, I have come to find the cradle of my race: I am told it is somewhere in these parts;" but wherever the English party went, he went with them. It turned out that he had been sent over to find out what the Mission were doing, and on pretence of looking for the cradle of his race, he settled himself in the English camp. Ultimately, as they did not want him with them, they gave him a horse, with provisions, and sent him to Kashmir, with a letter to the Maharajah, requesting him to send out people to receive him. He was well treated, and ought to have been exceedingly grateful, but, instead of that, he abused him (Sir D. Forsyth) in the most frightful manner. To have a discussion on Central Asia without Colonel Yule was like the play of 'Hamlet' with Hamlet left out; but what he would have said if he had been present might be gathered from his preface to Prejevalsky's work, where, alluding to subsequent travellers in that part of the world, he wrote that they merely followed in Marco Polo's footsteps, and their labours fell very far short of what Marco Polo himself had done. No doubt that was true, but in Marco Polo's days no European powers had appeared in Asia to disturb the equanimity of the people. Since then, however, they had learned to be rather afraid of Europeans. Until within the last fourteen or fifteen years the Chinese, who were masters of Yarkand and Kashgar, would not let any foreigner, European or Hindoo, enter the country, which was therefore a sealed book, until the wave of Mohammedan rebellion, which began in the Western portion of China proper, spread towards Yarkand and Kashgar; and then Yakoob Beg founded his kingdom. He was a very remarkable man, *sui generis*. It was quite true that he established his power by a great deal of severity, but the result was that the most perfect peace reigned throughout the whole of his kingdom to such an extent, that bales of goods which unfortunate travellers had been compelled, by the loss of their ponies or camels, to leave on the road, remained untouched, as nobody would dare to meddle with them. The inhabitants too were all Mohammedans, but of a different type from what had lately been supposed to characterise Mohammedans. They were a simple, industrious, hospitable, friendly people. Wherever the English party went they were received with the utmost kindness. This must be put to the good account of the late Yakoob Beg, who, however, was rather afraid of giving offence to the Russians, and therefore would not allow the Mission to carry out all the explorations that they had intended. The intention had been to go from Kashgar to Uksu, then to Lake Lob, and crossing to Tibet. Everything was arranged, but at the last moment Yakoob Beg sent a message to say that for certain reasons it would be better that the Expedition should be abandoned. The consequence was that the honour of discovering Lake Lob and the adjacent country fell to Colonel Prejevalsky, whom, when the proper time came, the Royal Geographical Society would no doubt welcome with due honour as one who had made a grand discovery. Yakoob Beg was assassinated about the middle of last year, and, in the anarchy which followed, the Chinese general was able to push his troops forward, and on the 6th or 7th of December to enter Kashgar. After slaughtering an immense number of people, he had now re-established the Chinese rule. He did not, however, think that all the male inhabitants had been killed. He hoped the Chinese would not fall back upon their old system of exclusion. By the Che-foo convention they had agreed to open many parts of the Empire, and perhaps they might be induced to allow the English to establish a Consulate at Yarkand. Setting aside these political considerations, he thought that a

country which, within the last eight years had produced three or four Gold Medallists, must be one in which the Royal Geographical Society would feel considerable interest. He trusted that Sir Henry Rawlinson and the other members of the Indian Council who were connected with the Society would do their utmost to keep that region open for the benefit of future explorers.

The PRESIDENT said the Council of the Society were perfectly unanimous in voting the Patron's Medal of the year to Captain Trotter, as one who had richly earned any distinction which they had it in their power to confer. It was quite clear that, at seasons of such intense cold, when to touch metal was to blister the fingers, to use his instruments with such effect as Captain Trotter had done must indicate the possession of some very rare qualities, not only of perseverance but of hardihood. If the region which had been described was really the cradle of the race, it must be a very large cradle, for it had sent forth a very numerous progeny. He could not agree with Sir Douglas Forsyth in his estimate of the slaughter which had taken place by the Chinese in the territory formerly governed by Yakoob Beg. He believed that they had, as nearly as might be, exterminated all the male inhabitants. They did the same thing in Yunnan, and when he was in Canton 70,000 men were decapitated in one year in the execution grounds. Sir Douglas Forsyth had not touched upon the physical difficulties which the passes presented to commerce, but he was afraid that there was not much chance of ever establishing a large and lucrative trade by caravans between India and Kashgar. Still it was desirable, if possible, to have a friendly and continuous communication between the two countries, and no doubt this would have been secured by such diplomatists as Sir Douglas Forsyth, and such accomplished scientific explorers as Captain Trotter, but for the assassination of Yakoob Beg and the destruction of the people over whom he had ruled. The Council had for some time been desirous that Captain Trotter's Paper should be read to the Society, but, owing to his absence from England, it had been delayed till this evening.

DR. THOMAS THOMSON—By the death of Dr. Thomas Thomson the Society has lost one of the earliest and most energetic of Trans-Himalayan explorers, and the first who put into a connected form a really scientific account of the geography, geology, and botany of the vast and complicated mountain regions extending from the plains of the Punjab to Turkistan.

Dr. Thomson was eldest son of Dr. Thomas Thomson, F.R.S., the eminent Professor of Chemistry in the University of Glasgow; in which city the son was born on the 4th of December, 1817. He was educated at the High School and University of Glasgow, and took his degree there as Doctor of Medicine in 1839. At school he obtained very high honours in classics and mathematics, but throughout his college career he preferred to devote his energies to scientific studies. From early childhood he evinced a remarkable love of, and capacity for, science, both physical and biological, commencing with chemistry and mineralogy before he went to school, and at a later period devoting himself to conchology and entomology, and lastly botany.

When only seventeen years of age, he was, when geologising on the Firth of Clyde, the first discoverer and the describer of those beds of fossil mollusca on which so much of the evidence of the glacial era depends. His account of the position and character of the deposits at Dalmuir is written with the acuteness, fulness, and perspicuity of a trained geologist; and the deductions he draws from a comparison of their contents with those of the neighbouring seas, show singular powers of generalisation for so young a person. He states in this paper that though the species are identical with those existing in the Clyde, the proportion of common to scarce is completely inverted: whence he concludes that they cannot have been deposited during a period when the fauna of the Firth of Clyde was in every way the same as at present; but that they are referable to a very late Tertiary period, when the banks of the Clyde, at least as far as Glasgow, were covered by an arm of the sea.*

It was his father's wish that he should make chemistry the profession of his life, and, to this end, for many years he worked a little

* The title of young Thomson's paper is, "On a Deposit of recent Marine Shells at Dalmuir, Dumbartonshire," 'Records of General Science,' vol. i. p. 131, February, 1835. This paper was published four years before that of Smith of Jordan Hill, on "Marine Beds resting on Till," which appeared in 1839 in the 'Memoirs of the Wernerian Nat. Hist. Soc.,' vol. viii. p. 49, wherein an allusion is made to Thos. Thomson's discovery.

daily at the University Laboratory, finally spending a winter at Giessen under Liebig, who regarded him as one of his most promising pupils, and under whom he discovered pectic acid in carrots.

On entering the medical classes, however, he returned to botany, under the stimulating lectures of the late Sir William Hooker, attending his course and herborizations annually during the whole of his medical curriculum, being further encouraged thereto by his friend, now Sir Joseph Hooker, who had been his school-fellow, and was afterwards his constant college companion. After taking his degree, being determined to devote his life to science, and especially to botany, he resolved upon entering the service of the Honourable East India Company as an assistant-surgeon. On his arrival in Calcutta, early in 1840, he was appointed to the Curatorship of the Museum of the Asiatic Society, and had commenced the arrangement of its fine collection of minerals, when he was ordered off to take charge of a party of European recruits who were being sent to Afghanistan. Leaving Calcutta in the beginning of August, it was not till June of the following year that this long up-country march was concluded; he then arrived at Cabool, where, and at Ghuznee, three months of thorough enjoyment were spent in studying the geology of the country and in exploring a wholly unknown flora.

At Ghuznee he was attached to the 27th Regiment of Native Infantry, and had his first attack of fever, soon to be followed by the horrors of the Afghan campaign, of which he was one of the few survivors. Very shortly after he had quitted Cabool, the detachment left there was destroyed, excepting a few of its officers and men who fled to Ghuznee, where, along with Thomson's detachment, they were beleaguered during the winter of 1841-2, and where, after daily losses of their comrades by cold, sickness, starvation, and the enemy's fire, they capitulated, to be subsequently imprisoned by their treacherous and savage captors. From Ghuznee Dr. Thomson and his fellow prisoners were afterwards sent to Cabool, and from thence were being transported to Bokhara to be sold into slavery; but, on their arrival at Bameean, they bribed their captor, for a ransom of 2000*l.* and a pension for life from the British Government, to conduct them back to the advancing British army of relief.

From Afghanistan Dr. Thomson returned to India, having lost all his collections and personal effects, and was stationed with his regiment at Moradabad till 1845, when he joined the army of the

Indus, and served with it throughout the Sutlej campaign; after which he returned to Moradabad, and was stationed at Lahore and Ferozepore till 1847. During this period he was always engaged in investigating the botany of the plains and outer Himalayas. Meanwhile Sir W. Hooker and other friends were actively exerting themselves to procure for him some scientific employment in India, which resulted in his being nominated one of three Commissioners appointed to lay down the territorial boundary between the Trans-Himalayan possessions of our ally the Rajah of Kashmir and the Tibetan provinces subject to China. The Commissioners were instructed, after so doing, to proceed to Léh, there to separate and travel each in such a direction as should seem to him most conducive to advancing our knowledge of the countries north of the Himalayas.

The Commissioners, consisting of Major Cunningham, of the Bengal Engineers, Captain Henry Strachey, and Dr. Thomson, left Simla early in August 1847, and followed the Sutlej valley to the Chinese frontier at Shipki, where they were to have met the Chinese Commissioners, who, however, did not appear. Permission to cross the frontier being refused, the party proceeded to Léh, where it arrived in October. Here Major Cunningham left for Kashmir, bent on archæology; Thomson, bent on geology, botany, and geographical discovery, proceeded northwards, crossed from the Indus to the Nubra valley, and traced the course of the Shayok to its confluence with the Indus, which he followed to Iskardo. Subsequently Captain Strachey also left on his journey south-eastward to the Mansarowar Lake. In December Thomson attempted to reach Kashmir by Dras, but, after severe suffering from cold and exposure, he, on arriving at Dras, found the Zoji La Pass closed, and was obliged to return to Iskardo, where he passed the remainder of the winter of 1847-8.

Early in the following spring, he attempted to trace the Indus downwards to its exit in the plains; but, on reaching Rondou, was prevented from proceeding further by the disturbed state of the valley. It is remarkable that no European has as yet followed this part of the Indus, which was for the first time explored only two years ago by a native in the service of the Trigonometrical Survey as related in another part of this Address. Returning to Iskardo, he again took the route to Kashmir, which he reached in April, and spent some months in studying the botany and geology of the valley, after which he returned to Léh, by Jamu, Kishtwar, and

Zanskar. From Léh he set out on a more extended exploring expedition northward, with the object of ascending the previously unscaled Kuen-lun Mountains, which separate Tibet from Eastern Turkistan. This he accomplished by following the valley of the Shayok River to its source at the Karakoram Pass, 18,200 feet above the sea, which he reached on the 19th of August, 1848. Dr. Thomson's return to India was made by Léh, Kashmir, and Jamu, at which last place he was detained for a considerable time by the unsettled state of the country during the second Sikh war.

The results of these extensive journeys were published after Dr. Thomson's return to England, in a narrative form, entitled, 'Western Himalayas and Tibet,' a work on which the President of this Society, Sir Roderick Murchison, when presenting the Founder's Medal to its author, pronounced the following eulogium : " Eminent among living naturalists, Dr. Thomson, in the course of his arduous expedition, in which botany was his chief object, traversed a large tract of wild and mountainous country hitherto unexplored, crossed, for the first time, the dividing range of the great Asiatic continent, brought back collections that link the labours of the Russian botanists in the north with those of the English in the south, and carefully laid down every feature in the physical geography and geology of the vast elevated region whence the Indus and its tributaries take their rise, amid glaciers and at enormous heights above the sea. Another rare merit is that he embodied these researches in a work which, whether for modesty of style, accuracy, as well as breadth of view, or as being the first to demonstrate the true physical structure of the mountain-masses of North-Western India, and to trace their water-systems, climate, and productions, must be considered as of the highest value by naturalists, geographers, and geologists. To Dr. Thomson we owe the abandonment of an idea long prevalent—that Tibet was an elevated plain or plateau; and with this fell also many subsidiary theories relating to the snow-line, glaciers, temperature, and climate, of Central Asia. In short, from the date of Thomson's researches, rational superseded conjectural geography as regarded that vast, and still to a great extent unexplored, area." . . . " Now, when I inform you, my associates, that for all these devoted and important services Dr. Thomson never received any reward, nor even public thanks, but, on the contrary, was left to publish his work at his own cost and to his heavy loss, you will all rejoice with me that, although we have much too long delayed our gift,

we have at last placed ourselves in a befitting position by rendering justice and all honour to such a distinguished man."

On returning to India he was stationed at Ferozepore, and six months' leave were allowed him to draw up his reports, and to put in order his immense collection for transmission to England. During this time, which under any circumstances was wholly insufficient for the purpose, he was repeatedly prostrated by fever. Being unable to obtain a prolongation of leave, he determined to take his furlough—to which he was entitled by length of service—and repair to Simla, where he recovered his health and completed his report. At Simla he added greatly to his botanical observations and collections.

Before leaving India for England, he determined to visit his old friend, Dr. (now Sir Joseph) Hooker, who had been travelling in the Eastern Himalayas while he was in the Western. On reaching the plains he was again attacked by fever of a virulent type, during a stay at the Botanic Gardens of Saharunpore; and from the effects of this fever on a constitution already enfeebled by previous illness and great hardships he never completely recovered. He arrived at Darjeeling, in the Sikkim Himalayas, in the winter of 1848, to find his friend a prisoner in the power of the Sikkim Rajah, from which he did not escape till some weeks after his arrival.

The prospect of a year's travelling with one whose pursuits so entirely accorded with his own tastes, induced him to abandon his intention of returning to England. He endeavoured, through that friend's interest with the Governor-General, to obtain an extension of leave for the purpose of spending a year in scientific explorations; but the powers that then ruled India had no sympathy with science; medical officers were scarce, and no concession was obtainable. Dr. Thomson, therefore, resolved to remain on his own resources, with the certain loss of a year's service, trusting that on his return to England a more liberal view of his disinterested labours would be taken by the Court of Directors of the India Company.

The year 1850 and spring of 1851 were spent in the Sikkim forests, the Khasia mountains, Cachar, Chittagong, and Sunderbunds; during all this time Dr. Thomson worked indefatigably, though he suffered constantly from gastric irritation and fever. He returned to England in March 1851, in very broken health, but laden with enormous collections and botanical and geological observations. Soon after his arrival in England, he began, at his own expense, the distribution of his herbarium amongst the principal

Museums in Europe and America: while great efforts were being made by his friends, backed by a strong recommendation from the President and Council of the British Association, to induce the Court of Directors of the East India Company to grant him some aid towards this work, as well as towards publishing an account of his labours, either by allowing the time of his furlough to count as service, or otherwise; but it was all in vain. Whilst thousands were being expended by the Company on foreigners (the brothers Schlagintweit), who were actually travelling over the same ground that Thomson had explored, the utmost that could be extorted for the latter was a promise that when the first volume of the 'Flora of British India' (which he proposed to publish in conjunction with his fellow-traveller) should appear, his services should be favourably considered. Under these circumstances the work was commenced, the first volume was printed wholly at Dr. Thomson's expense, and sold at cost price. On application for the promised "consideration of his services," he was informed that the Honourable Company had bought some copies of the volume, and that nothing more was to be expected! The work, which embodied a marvellous amount of Thomson's valuable observations, especially on the morphology of Indian plants, together with a conspectus of the physical and botanical geography of every district of India, from Tibet to Cape Comorin and the Malay Peninsula, had consequently to be abandoned.

On the retirement of Dr. Falconer from the superintendence of the Botanic Gardens at Calcutta, in 1854, the appointment was given to Dr. Thomson, who held it in conjunction with that of Professor of Botany at the Calcutta Medical College. During all this second residence in India he suffered from repeated attacks of fever and aggravated dyspepsia, which obliged him to repair sometimes to the Sanatorium at Darjeeling, and at others to the sea. Finally, in 1861, he returned to England a confirmed invalid.

For the remainder of his life Dr. Thomson resided first at Kew, and subsequently at Maidstone, making, however, frequent changes for the benefit of his health. On one occasion, indeed, he again went to India for a short period, namely, on that of the eclipse of 1871, when he was employed as secretary to the Expedition, and when his knowledge of the country and languages was of the greatest use to its members.

The last few months of his life were spent in London, where he died, after protracted sufferings from malignant disease, on the 18th of April, 1878.

Dr. Thomson was elected a Fellow of the Linnæan Society in 1852, of the Royal in 1855, and of the Royal Geographical in 1854. He was for twelve years an Examiner in Natural Science for the Medical Services of the Army and Navy, and, on several occasions, Examiner in Botany of the University of London and the South Kensington School of Science.

From his youth till he was disabled by disease he was remarkable for his bodily activity and powers of endurance; he was an excellent mountaineer, and a daring cragsman.

Though capable of great mental exertion, and possessed of a vast amount of singularly accurate botanical knowledge, he was ever diffident of his powers and morbidly averse to publication. At the same time he was of a most amiable disposition, and obliging to a fault, his time, substance, and stores of information being at the disposal of all comers. He was a great reader and good linguist, and, when imprisoned at Ghuznee, having no other books than a Persian Dictionary and a copy of Lyell's 'Principles of Geology,' he managed with the former and the aid of his gaoler to make himself master of Persian, varying his studies with chapters of the latter work, which, during his imprisonment, he read through *verbatim* seven times. Dr. Thomson married, in 1854, Catharine, daughter of R. C. Sconce, Esq., of Malta, who survives him. He left no family.

Major-General Sir ANDREW SCOTT WAUGH, R.E., F.R.S. Our Society has lost in this distinguished Indian officer one of its principal Members, who for a long period served on its Council, and was for four years, from 1867-70, one of its Vice-Presidents. He was the son of General Gilbert Waugh, Military Auditor-General at Madras, and was born in 1809. After a course of education at Edinburgh High School, he proceeded to Addiscombe, and there displayed so much ability and diligence that he passed through the course of studies in less than half the ordinary period, and came out first of his term, with the result of being especially recommended to the Court of Directors and, by Sir Charles Pasley, to the Chief Engineer of Bengal. He landed in India on the 25th of May, 1829, and thereupon entered upon his long career of service, which extended over a period of more than thirty years. On his arrival he was posted, as usual in the Engineer branch, for which he had been trained, to the Sappers and Miners, being afterwards promoted to the Department of Public Works, and various other special offices. In July 1832 he was appointed to the Great Trigonometrical

Survey, with which important scientific department he remained connected down to his final retirement in 1861. He had the great advantage in commencing his survey work to be under the immediate direction of that experienced and gifted geodesist, Sir George (then Colonel) Everest, who instilled into him the importance of extreme accuracy in the kind of work he was then entering upon; and it was whilst acting as astronomical assistant to his chief that he took part in the measurement of the great arc of the meridian extending from the Cape Comorin, in the extreme south of the Indian Peninsula, to Dehra Doon, at the foot of the Himalayas. In December 1834 he continued his work as assistant to the Surveyor-General, by measuring the northern base-line in Dehra Doon, an operation that extended over a year. Further operations of a similar character were carried on during the subsequent years, embracing many hundred miles of country, and with such surprising accuracy that when the result came to be tested by independent measurements the difference between them proved to be only six-thousandths of an inch per 100 feet. In short, as Major Godwin-Austen observes, it was during those years that the Indian Surveys were placed on their present footing, and the whole system was elaborated to the high pitch of excellence which has since distinguished it. Our late colleague was indeed fortunate in enjoying the esteem and confidence of such a chief as Everest, under whom he worked for a period of ten years. It was mainly owing to the high opinion the latter entertained of him, and the warm eulogium which he passed, when writing to the Court of Directors on his professional and moral qualifications, that Waugh, then only a Lieutenant of Engineers, received in 1843 the appointment of Surveyor-General and Superintendent of the Topographical Survey of India. The service subsequently rendered by him, however, amply proved the wisdom of the choice.

It was Waugh's first object on succeeding to the appointment of Surveyor-General to keep up and improve the system founded by Colonel Everest. One of the finest of the operations of the great Trigonometrical Survey was the one he immediately proceeded to carry out, called the "North Eastern Himalaya Series," connecting the northern ends of the meridional series. Waugh himself took a personal and leading part in this work, which was carried on for hundreds of miles along the deadly Terai at the base of the Himalayas, and proved fatal to many of the European officers and assistants engaged in it. It was during this survey that Mount Everest, the highest and grandest peak of the Himalaya,

and indeed of the world, was trigonometrically measured, and named by Waugh after his friend and predecessor.

The system projected by Sir George Everest was completed about 1847-8, and Colonel Waugh had then to deal with the vast territory, much of it newly acquired, that lay in Scinde, the North-West Provinces, and the Punjab. "In this area, again," says Major Godwin-Austen, "the difficulties met with were considerable, especially in the desert which the party under Captain Strange had to cross. The Chach base, near Attock, was measured in 1852-3; and here a fine officer, Logan, who had served at the measurement of every base-line since 1831, succumbed to the effects of previous exposure in the field. In 1854-55 the next base was taken in hand at Kurrachee, also under Colonel Waugh's immediate supervision; and in 1856 the Indus series was in progress, under Major J. T. Walker, the present Surveyor-General; the Mutiny breaking out much delayed this work, which was finally completed in 1860."

In 1857 Colonel Waugh was awarded, in his absence, the Patron's Gold Medal of the Society, Colonel Everest representing him on the occasion. In 1858 he was elected Fellow of the Royal Society. About this time the survey of Kashmir was commenced, a work which attracted more public attention in England than the preceding sections of the Indian Surveys, owing to the interesting nature of the country and the grandeur of its surrounding mountains. This great and important work was not completed until 1864, three years after Waugh's retirement.

Soon after his return to England in 1861, with the usual honorary rank of Major-General, Waugh received from Her Majesty the honour of Knighthood. So great was the personal regard in which he was held by his fellow-workers in the Department, that when he left India 192 members joined in presenting him, on his retirement, with a farewell address and a service of plate. He died on the 21st of February last.

Colonel T. G. MONTGOMERIE, R.E.—This eminent officer, one of our Gold Medallists, and a frequent contributor to the pages of our 'Journal' and 'Proceedings,' died on the 31st of January last, at Bath, where he had resided since his retirement from active service in 1873. He was the fourth son of the late Colonel W. E. Montgomerie, of Annick Lodge, Ayrshire, and was born on the 23rd of April, 1830. After completing his education at Addiscombe, in 1849, where he came out first of his term, carrying away the

Pollock Medal, he entered the East India Company's Service as Lieutenant in the Bengal Engineers, and departed for India in the summer of 1851. He had not been more than a year in ordinary service at the head-quarters of his corps, when he was posted to the Great Trigonometrical Survey, then under the direction of Colonel (afterwards Sir Andrew) Waugh. In this congenial sphere his abilities quickly told, and, after two or three years of detailed survey-work at Chach and Karachi, he was entrusted by his chief with the important task of conducting the survey of Kashmir, and the stupendous pile of mountains stretching thence to the borders of Tibet. For ten years he was occupied in directing operations in this arduous but interesting field; comprising an area of 70,000 square miles of rugged country, much of which was previously entirely unknown. In carrying out the measurements the stations of the survey-parties were obliged frequently to be made at altitudes of from 15,000 to 20,000 feet. Indeed, Mr. W. H. Johnson, one of the surveyors, is stated to have set up his theodolite on a peak near the Changchenmo Pass, elevated 20,866 feet above the sea. During the survey the little-known regions of Baltistan, Ladak, and the high plateaux near the Pangong Lake, were explored, and many important valleys, lofty peaks, and gigantic glaciers, made known for the first time. Papers descriptive of the new districts surveyed were communicated to this Society from time to time, and always excited the most lively interest. Among these was one by Captain Godwin-Austen, on the "Glaciers of the Mustakh Range," which gave a vivid description of the wild valleys and snow-clad ridges north of Iskardo on the Upper Indus, which he surveyed in the summers of 1860 and 1861. Another was by Mr. W. H. Johnson, recording his daring excursion beyond the boundaries to Ilchi, in Khotan, in 1865. The difficulties and privations attendant on the survey of these remote and elevated regions, and the names of the various officers employed, were noticed by Earl de Grey (now Marquis of Ripon) in his Presidential Address to the Society in May 1860. In 1864 the Kashmir Survey was completed, and in the following winter Montgomerie came home on sick leave. In May 1865 he received at the hands of Sir Roderick Murchison the Founder's Medal, in recognition of the important Geographical work he had performed. Returning to India in 1867, Captain Montgomerie gave increased attention to the subject of exploration beyond the Himalaya by trained natives, which had, previous to his visit to England,

occupied much of his time and thoughts. The employment of British officers in such a work being impracticable, owing to the political complications which might arise with barbarous Native States beyond the frontier, the training of skilled native observers for survey purposes had been seriously taken in hand; the plan being to equip these men as traders, and send them, with their sextants and compasses concealed, to make route-surveys successively in every part of the unknown region north of the mountains. A beginning was made in 1863 by the employment of Abdul Hamid on the route to Yarkand; but the greatest successes were achieved by the well-known Pundits who explored almost the whole of Southern and Western Tibet, in the years from 1865 to 1875, and brought back from their various journeys such well-kept itineraries and records of observations that Montgomerie and his successor were enabled to construct fairly accurate Maps of a vast extent of previously almost unknown country. The narratives of these explorations, illustrated by Maps reduced from those given in the official Reports of the survey, have been given in successive volumes of our 'Journal';* and last year we crowned our approval of the eminently useful work performed by giving one of the Royal Medals of the year to Nain Singh, the so-called "original Pundit," who commenced by surveying the Upper Brahmaputra and determining the position of Lhása in 1865, and finished by the remarkable journey, on which he was sent by Captain H. Trotter, through Tibet from north-west to south-east, and across the Himalaya into Assam. In 1870-2 Captain Montgomerie officiated, during the absence of Colonel Walker, as Superintendent of the Great Trigonometrical Survey; but in 1873 he was compelled by ill-health again to return to England. His native air and repose from official duties seemed to have little effect in restoring him to strength, and in 1876 he was compelled to retire

* 1. "On the Geographical Position of Yarkand," &c., vol. xxxvi.

2. "Report of a Route-Survey made by Pundit;—from Nepal to Lhása, and thence through the Upper Valley of the Brahmaputra to its Source," vol. xxxviii.

3. "Report of the Trans-Himalayan Explorations during 1867," vol. xxxix.

4. "Report of the Mirza's Exploration from Cabul to Kashgar," vol. xli.

5. "A Havildar's Journey through Central to Faizabad in 1870," vol. xlii.

6. "Narrative of an Exploration of the Namcho or Tengri Nur Lake in Great Tibet, made by a Native Explorer," vol. xlv.

7. "Journey to Shigatze in Thibet, and Return by Dingri Maidan, into Nepaul in 1871, by a Native Explorer," vol. xlv.

8. "Extracts from an Explorer's Narrative of his Journey from Pitoragarh in Kumaon, *via* Jumla to Tadam and back, &c.," vol. xlv.

9. "Account of the Pundit's Journey in Great Tibet, from Leh in Ladakh to Lhasa, and of his Return to India *via* Assam," vol. xlvii.

from the service. He occasionally appeared during these years of retirement among us, and took part in the discussions at our Evening Meetings; and in 1875 he acted as Agent of the Society and as British Commissioner at the Geographical International Congress held that year at Paris.

Professor ADOLPHE ERMAN, Gold Medallist and Honorary Corresponding Member of the Society, died at Berlin, his native place, on the 12th of July last, at the age of 71 years. He attained great eminence and celebrity for his researches in terrestrial magnetism, in carrying out which in early life he made his well-known journey round the world, publishing the general results of his travels in the work, still often quoted, entitled, 'Reise um die Erde, durch Nord Asien, und die beiden Oceane, in den Jahren 1828, 1829, und 1830.'

The first part of his journey was made in company with the celebrated Norwegian magnetist Hansteen; with him the northern parts of Russia and Western Siberia were visited, and their magnetic phenomena investigated. But, on the termination of this joint undertaking, Erman continued his travels alone to Kamtschatka, making excursions to the Icy Sea on the north and the Wall of China on the south. Embarking at Kamtschatka, he crossed the North Pacific to Sitka, and returned to Europe *viâ* Cape Horn, touching at San Francisco in California, Tahiti, and Rio Janeiro. His researches were not exclusively confined to Magnetism, but every opportunity was taken of fixing astronomically the position of places and their elevation above the level of the sea; and valuable collections were also made of the botanical and zoological productions of the countries visited. Soon after his return to Prussia, Erman was made Professor of Physics in the University of Berlin, a post which he occupied up to the time of his death. His later years were busily employed in physical investigations and the publication of numerous treatises ranging over nearly every branch of the natural sciences, and his last work, on the magnetic phenomena of 1860, was left unfinished at his death. He received the Patron's Medal of our Society, at the hands of the President, Sir (then Mr.) Roderick Murchison, in 1843, and was elected one of our Foreign Honorary Members in the same year. An analysis of his published travels was published in vols. vi. and ix. of the 'Journal' of the Society, and an English translation of part of the work, from the pen of Mr. Cooley, was published in London in 1848.

Rear-Admiral WILLIAM SMYTH.—This officer distinguished himself in early life by his enterprising journey across the Andes from Lima, and thence down the Ucayali and Amazons Rivers to the Atlantic, and by the interesting narrative of his voyage which he published in 1836. Smyth himself relates that he was induced to undertake the journey by the accounts he heard at Lima, during the stay at Callao of H.M.S. *Samarang*, in which he then served as Lieutenant, of the possible navigability of the Amazons from the upper waters of one of its tributaries, the Pachitea, not far from Lima, down to the sea. Having obtained leave from the Commodore and promises of support from the Peruvian Government, he set out on his journey, in company of Mr. F. Lowe, of the same ship, in September 1834, reaching Pará, near the mouth of the Amazons, in 1836. The reluctance of the Indians at Pozuzu and on the Mayro branch of the Pachitea, where it was necessary to embark on the downward voyage, prevented his carrying out the original programme of his Expedition; and he was compelled to take the better known, but not much less adventurous and difficult, route of the Huallaga, a river flowing northward between the two easternmost ranges of the Andes, and joining the Amazons some 150 miles higher up than the Ucayali. The Huallaga, however, is a rocky stream, much obstructed by cataracts and rapids, and its exploration did nothing to promote the original object of Smyth's gallant undertaking; the hopes of patriotic Peruvians centring then, as they have always done, on the broad and deep Ucayali, which flows gently along the level alluvial plains east of the Andes. Smyth's journey was, however, fruitful in new Geographical information, and his Map of the Upper Amazons, founded on his own observations and surveys, was by far the most accurate and complete which had been published to that date. Admiral Smyth lived long enough to see the practicability of the route which he had attempted to explore proved by the Peruvians themselves, steamers having within the last few years ascended from the Amazons to the little Indian village on the banks of the Mayro, whence he was reluctantly compelled to retrace his steps. Soon after his return from South America, in 1836, Admiral Smyth served as First-Lieutenant of H.M.S. *Terror*, under Sir George Back, during the memorable voyage towards Repulse Bay, when the *Terror* wintered in the pack, in daily peril of destruction, and, returning across the Atlantic in a sinking state, was finally run on shore on the coast of Ireland. He was an admirable draughtsman,

and supplied the well-known sketches to illustrate Sir George Back's work. He died on the 25th of September last, having been for 40 years a Fellow of the Society.

Mr. HENRY DANBY SEYMOUR.—Among the many losses which the Society has sustained during the past year, none perhaps has been more severely felt than that of Mr. H. D. Seymour, who died quite suddenly in August last, at the comparatively early age of 57. Mr. Seymour's loss has been especially felt, not only as that of an old and valued Fellow of the Society, but because he was one of the most active and efficient Members of our Council, full of information on those matters which chiefly occupy our attention, and ever ready to place his time and experience at the disposal of the Society for the transaction of its business, or in furtherance of the general interests of Geography.

Representing a junior branch of the House of Somerset, and the heir to considerable landed property in the West of England, Mr. Seymour received the standard education at Eton and Christchurch, which is bestowed on young men in his position in life, but which, however it may fit them for legislators or country gentlemen, does not usually develop a taste for scientific or observant travel. Mr. Seymour, however, had the instincts of a traveller from his birth, and no sooner, accordingly, had he finished his University course than he started for the East, where, during three years of continuous wandering, he visited many regions at that time little known to Englishmen, and collected a vast amount of information with regard to the social and political condition of the inhabitants of Western Asia, which stood him in good stead in after years. At the outset of his travels he carefully studied the position of Russia in the Crimea and on the shores of the Black Sea. Subsequently he passed a season in the Caucasus, and for some time took up his abode with the Dadian family in Mingrelia, thus gaining acquaintance with a people and a country quite beyond the range of ordinary travellers. From the Caucasus Mr. Seymour rode to Teheran : and then continued his journey through Western Persia to Baghdad ; from whence, after visiting the ruins of Babylon, he turned northward, and joined Mr. Layard at Nineveh, subsequently traversing the Kurdish mountains by the difficult route of Bitlis and Van, till he recrossed the Arras to Erivan. It was on this occasion (September 1846) that he succeeded in ascending to the summit of the mountain popularly

known as Ararat, a feat which has been since not unfrequently repeated, but which at that time had never been accomplished except by Professor Parrot in 1829, and Herr Abich in 1845, and which indeed, in spite of all evidence to the contrary, the Armenians of the neighbourhood still assert to be impossible. As Mr. Seymour did not publish an account of his ascent of Ararat when it took place, his name is seldom or ever included in the list of the successful climbers of the mountain; but there can be no doubt that he did really perform this very difficult feat, a letter in pencil which he wrote from the summit being still preserved in the family, and the Russian authorities at Erivan having duly recorded his success at the time. After another year's travelling in the south of Russia, Mr. Seymour returned to England in 1847; and having succeeded to the family estates in 1849, he entered the House of Commons in 1850 as Member for the Borough of Poole, and commenced at once an active Parliamentary career. Through that career it will be unnecessary to follow him. Let it suffice to say that, holding advanced Liberal opinions, and being a ready and effective speaker, he took an active part in the debates from his first entry into the House, advocating Free-trade, Reform, and other popular measures, and being on all occasions a steady and consistent supporter of Lord Palmerston's policy. In some important matters, indeed, his public services were conspicuous. Desiring to obtain a practical knowledge of India, he visited that country in 1853-54, and took all possible pains to acquaint himself with the condition of the people. On returning to England he brought his experience to bear on many current questions of interest, and especially in reference to the system of torture which was carried on by the police authorities in Southern India, and the exposition and abolition of which was mainly due to the energy and perseverance displayed by him in bringing the subject under the notice of Parliament. Mr. Seymour, indeed, proved himself at this time so well acquainted with Indian affairs, and of so much use to the Government of the day, that in 1855 he was appointed Secretary to the Board of Control, an office which he continued to fill until Lord Palmerston's Administration fell in 1858. During his subsequent career in Parliament, which continued until 1868, Mr. Seymour exerted considerable influence in the treatment of all questions relating to the East, and—be it said to his honour—never failed to raise his voice in defence of the rights and interests of the people of India.

In an interval of his Parliamentary work, Mr. Seymour also

made an interesting journey to Fort Garry and the Red River, then rarely visited by English travellers, and thus gained a practical acquaintance with the Canadian frontier, which often enabled him to enliven discussions and contribute to our instruction, at our Evening Meetings.

It should further be noticed, that although Mr. Seymour's attention was principally directed to political affairs, his literary efforts were not inconsiderable. Having revisited the Black Sea in 1854, at the commencement of the Crimean war, and finding that public interest was greatly excited as to the History and Geography of that region, he published in 1855 an account of his earlier travels, with much additional research, under the title of 'Russia in the Black Sea and Sea of Azoff:' and this unpretending work, which had a great success at the time, having rapidly passed through three editions, is still considered a standard authority—in fact, the best authority that we possess—on the statistics and general characters of the Russian position in that quarter. Mr. Seymour had also made considerable progress with two other works, describing his residence in the Caucasus and his tour through India, but it may be doubted if the MS. of either of these works is sufficiently advanced to admit of the volumes being published.

A further very important contribution which he made to our knowledge of the Geography of the East, was his edition of Messrs. Ferrier's 'Caravan Journeys,' translated from the French under his superintendence, and published in 1856, with the addition of an extensive and most valuable series of notes and emendations.

Later in life Mr. Seymour amused his leisure by translating, with the approval and assistance of the author, Brugsh Bey's celebrated 'Egyptian History.' He left this work in a very forward state, having already printed two volumes, and being occupied in correcting the proofs of the opening chapters of the third volume when he was struck down by apoplexy. The translation has been since finished, and the complete work will be very shortly published by Mr. Murray of Albemarle Street.

Mr. Danby Seymour was also well known as an art connoisseur. Having inherited a valuable collection of pictures and prints, and especially of old French enamels, and having moreover cultivated a taste for art from his earliest years by extensive study both at home and abroad, he had attained considerable celebrity in that department of knowledge. As one of the founders, too, of the Arundel Society and of the Fine Arts Club, he ever strove to

stimulate the popular taste for such studies, and the Loan Exhibition at South Kensington, which has done so much to promote the diffusion of art knowledge among the public, has been rarely without some fine specimens from Mr. H. D. Seymour's collection.

Mr. Seymour retired from Parliament in 1868, in consequence of the Borough of Poole being curtailed of one of its members, but he did not by any means lose his interest in public affairs, or indeed abandon the hope of re-entering Parliament. He contested the Borough of Shaftesbury in the Liberal interest in 1873, and although unsuccessful on that occasion, would probably have secured a seat at the next General Election. In the meantime he had been elected to a seat at the London School Board (1877), and had devoted himself with his accustomed energy to the improvement and extension of our system of popular education.

In conclusion, it may be said that Mr. Danby Seymour was a kind and genial companion, a good Geographer, a cultivated English gentleman, an able and honest politician, and a thorough hard-working friend of the people. His loss will be felt in many quarters, but nowhere more severely than at the Council Board of the Royal Geographical Society, where for so many years he shared our solitudes, and laboured hard to support and vindicate our interests.

Mr. ROBERT SWINHOE, long resident in China as Consul at various ports, was more widely known in the scientific world as a Zoologist than as a Geographer. He was, however, a meritorious observer of the general features of the various districts which his public duties required him to visit, and contributed valuable accounts of his journeys to this Society, with which he had been connected as Fellow since the year 1863. Thus, in vol. xxxiv. of the 'Journal,' appeared his notes on the Island of Formosa, including an account of his journey across the northern part of the island whilst fulfilling the duties of Vice-Consul at Taiwan-foo. In 1869, whilst Consul at Amoy, he sent us a narrative of "a Trip to Kalgan in the autumn of 1868," which was published in the 'Proceedings,' vol. xiv.; and some few months afterwards, in May, 1870, he read personally, at one of our evening meetings, a paper on the Special Mission up the Yang-tsze-Kiang, on which he was employed by my orders in 1869, at the time I had the honour of occupying the post of her Majesty's Minister in Peking. The object of this mission was to enquire into the trade of the Upper Yang-tsze, and in carrying it out he

ascended the river as far as Chung-King-foo in Se-chuen. The paper was published in vol. xl. of the 'Journal,' accompanied by an admirable map of the river, from the charts of the naval surveyors who were sent up the Yang-tsze for this purpose. Mr. Swinhoe was born at Calcutta in 1836, and went out to China as student-interpreter at the age of eighteen. He retired from the service, with constitution completely shattered, in 1874, and died on the 28th of October last.

Mr. W. S. F. MAYERS, Chinese Secretary to the British Legation at Peking, died on the 24th of March last at Shanghai of typhus fever. By the death of this accomplished Sinologist, which has occurred before he had reached the full maturity of his powers (his age being only forty), the diplomatic service of Her Majesty has sustained a heavy loss. He was born on the 7th January, 1831, in Tasmania, where his father the Rev. M. John Mayers, the present rector of St. Peter's, Winchester, was then Colonial Chaplain. The father being subsequently appointed Consular Chaplain at Marseilles, young Mayers received the chief part of his education in that place, and became a proficient in several modern languages. He first went to China in 1859, as a Student Interpreter, and so wonderful were his linguistic gifts and acquirements, that he mastered the rudiments of the Chinese language within a few weeks of his landing. At the end of his first year's service he was appointed interpreter to the Allied Commission charged with the government of Canton, and fulfilled the duties of the post so much to the satisfaction of his superiors that, on the evacuation of the city by the allies in 1861, he was appointed to the important office of interpreter to the consulate at Canton. In the course of the succeeding years he filled various consular posts at Chinese ports, until, in 1872, he received the appointment, which he held up to his death, of Chinese Secretary of Legation at Peking. In the same year he paid a visit to England, and was a frequent visitor at the rooms of our Society. His literary activity was at the same time shown by his preparing during the summer months a valuable paper on the 'Panthays of Yün-nan,' which he read to the Geographical Section of the British Association, which met that year at Brighton, in the month of August. His numerous works and papers on the subjects which he made the subject of his life, were, however, better known in China than in this country. He was a frequent contributor to the periodical literature of the time, English, American and

Chinese, and some of the most important articles in the 'China Review' at Hong Kong were from his pen. Of his works, published separately, the principal are:—'The Chinese Readers' Manual,' Shanghai, 1874; 'The Treaty Ports of China' (edited in conjunction with Mr. Dennys and Lieut. Charles King, R.M.A.); 'The Anglo-Chinese Calendar Manual,' 1875; a volume 'On the Foreign Treaties with China,' Shanghai, 1875; and a work on the 'Government of China,' which he was passing through the press at the time of his death. His 'Official Report on the 'Famine in the northern Provinces of China' has been recently issued as a parliamentary paper, and a learned paper on the Lamaist septem in Tibet, was published in the 'Journal of the Royal Asiatic Society' for 1869. Students of Chinese in this country have reason to be for ever grateful to our deceased Associate for the great service he rendered in procuring for the British Museum one of the few existing copies of the 'Imperial Compendium of Chinese Literature' in 5020 volumes, now safely deposited in the National Library. He had been a Fellow of our Society since 1861.

Sir WILLIAM STIRLING MAXWELL, Bart., K.T., M.P.—Among the most eminent of the Fellows whom the Society has lost in the past year by death must be mentioned Sir William Stirling Maxwell, Bart., K.T., M.P., for some twenty years well known in society and in literary circles as William Stirling of Keir. He was the only son of Mr. Archibald Stirling of Keir, and was born in 1818, his mother being a daughter of Sir John Maxwell of Pollock, Bart. On the demise of that lady's brother, also Sir John Maxwell, in 1866, his lands and estates, and subsequently his title, devolved upon her son, who had already, in 1847, through the death of his father, inherited the noble estates of Keir and Cawder. William Stirling of Keir was not, however, distinguished only by a high social position, but by eminent personal accomplishments. In 1848 he published his well-known and now exceedingly costly work, it being out of print, 'Annals of the Artists of Spain,' the result of a lengthy sojourn in that country before the period of his father's decease. This highly-prized work was not, however, the first which brought its author's name before the public. He had already, in 1846, published a volume of 'Songs of the Holy Land.' His name being thus favourably known, it is not surprising that a work so pleasantly written as the 'Cloister Life of the Emperor Charles V.' for which his intimate knowledge of Spain and the

for those of his father. He became a magistrate at Bombay, and held a seat in the Presidential Legislature. No Oriental prejudice prevented him from having a deep feeling for art, and his library was adorned with some very splendid pictures. He was fond of music also; and, although not much of a sportsman himself, delighted in his stud, which he freely placed at the service of his military English friends. The chief point of interest, however, in the late baronet's career, as well as that of his father, was the unceasing effort that he made to weave fresh links between India and England, to prevent the one from supposing itself capable of ever being severed from the other, and to imbue the Indian mind with an appreciation of European manners. After a lingering illness, said to have been brought on by the shock he received by an accident to a railway train between Bombay and Delhi, this valued friend of England died at Poona at the age of sixty-six.

Sir JAMES PHILLIPS KAY SHUTTLEWORTH, Bart.—On the 26th of May last year, died at his residence, 63, Cromwell Road, Sir James P. Kay Shuttleworth, who for more than twenty years had been a Fellow of our Society. The deceased Baronet took an active part in the subjects of Sanitary Reform and Public Education, and was for some time Secretary to the Committee of Council of Education, in which post he was mainly instrumental in establishing a system of school-inspection by officers appointed by the Government. He was created a baronet on retiring from his office in 1849. In 1864 he was High Sheriff of Lancashire, of which county he was a Magistrate and Deputy-Lieutenant. Sir James had assumed the additional name of Shuttleworth by Royal licence on his marriage in 1842 with Janet, only daughter of the late Mr. Robert Shuttleworth, of Gawthorpe Hall, Lancashire. In 1870 he received the honorary degree of D.C.L. from the University of Oxford. Sir James was the reputed author of the well-known novel of 'Scarsdale,' and of a volume of 'Modern Ballads of Lancashire,' among which are several short poems in the East Lancashire dialect.

Besides the above-mentioned, the Society has lost during the year many Members of high position, or distinguished merit in other walks of life than those connected with Geography. At the head of the mournful list stands His late Majesty VICTOR EMANUEL, KING OF ITALY, one whom we were proud to associate with us as an Honorary Member, and who gave during his brilliant and successful reign many tokens of the high regard in which he held

Geography and Geographical Explorers. Our African travellers and discoverers were especially singled out for notice by him and his ministers, from the time when Speke, returning from his discovery of Victoria Nyanza, was honoured by the Gold Medal with the device "Honor est a Nilo," down to Stanley, in passing through Italy after his last memorable journey across the continent. We have lost also Lord KINNAIRD, a Member since 1867, who died on the 8th of January, at the age of seventy-one years:—Lord HENRY PERCY, brother to the present Duke of Northumberland, distinguished for his military services as officer in the Grenadier Guards, and for special gallantry in the Crimean War, who died on the 3rd of December last:—Lord SOUTHWELL, fourth peer of that name, whose death occurred, at the early age of forty-two, on the 26th of April:—Admiral the Hon. H. J. ROUS, one of our oldest Members, whose election dated from 1839, and who, although known in his later years almost solely in connection with "the Turf," had been in his time a Geographical Discoverer, inasmuch as whilst commanding H.M.S. *Rainbow* in the Australian seas, in 1824, he discovered Richmond River, north of Sydney:—Admiral GEORGE EVANS, for many years Conservator of the Mersey, who died on the 15th of March, at the advanced age of eighty-one years:—Admiral Sir CHARLES EDEN, K.C.B., one of the Lords of the Admiralty in the years 1860 to 1866, whose death occurred on the 7th of March:—Admiral the Hon. Sir F. W. GREY, G.C.B., third son of Earl Grey, the Premier under whom the Reform Bill of 1832 was passed. This eminent officer saw much service in South Africa in the years that followed the Crimean War, during which he was Naval Superintendent in the Bosphorus. He died on the 2nd of this month, at the age of seventy-two:—Sir FRANCIS GOLDSMID, Bart. (M.P. for Reading), whose lamentable death by accident at the Waterloo Railway Station on the 2nd inst. must be fresh in the minds of you all. He will be long remembered as a munificent contributor to the endowments of University College, London:—Sir WILLIAM MITCHELL, who died on the 1st of this month, whose memory will be held in remembrance for procuring the adoption, by his energy and advocacy, of the system of examination for Commanders of Merchant Vessels, and who was Editor and Proprietor for thirty years of the 'Shipping and Mercantile Gazette.' He was knighted for his exertions in the establishment of an International Code of Signals for the use of all nations:—Mr. JAMES MURRAY, who served his country well and zealously for forty-three years as clerk in the

Foreign Office, rising through the various grades to the post of Assistant Under-Secretary of State. He had been a Member of our Society for thirty-three years:—Mr. ROBERT HOLLOND, of Stanmore Hall, who represented the borough of Hastings in Parliament for fifteen years, and distinguished himself in early life (in 1836) by his memorable aerial voyage to Germany in the Nassau balloon:—Mr. J. C. MARSHMAN, whose energetic career in India—first as Baptist Missionary and afterwards as reformer of native education and founder of the weekly newspaper ‘The Friend of India’—rendered his name famous throughout our Indian possessions. The death of this able man and enthusiastic philanthropist occurred on the 8th of July, 1877:—Mr. W. S. LINDSAY, the well-known merchant and shipowner, and Member of Parliament, who joined our Society in 1855. His name will be remembered hereafter for his ‘History of Merchant Shipping,’ an important contribution to British Maritime Annals. He died on the 28th of August last. To this list may justly be added the name of Mr. CHARLES LAMBERT, a merchant of the city of London, who bequeathed the munificent sum of 25,000*l.* to his son, Mr. J. Lambert, to be distributed in gifts to Scientific Institutions. Mr. Lambert had been a Fellow since 1864, and his son set apart 500*l.* as our Society’s proportion of the bequest.

The following are also among our losses since the last Report:—Mr. C. D. Bell (Surveyor-General, Cape of Good Hope), Mr. J. H. Bainbridge, Mr. Christopher N. Bagot, Mr. J. Brown, Mr. Alfred Burton, Mr. William S. Burton, Dr. Donald Burton, Mr. Charles Brett, Mr. Henry Bond, Mr. William Carr, Mr. Richard Davis, Mr. W. G. Dick, Mr. Thomas Dix, Mr. William Falconer, Mr. Daniel Griffin, Mr. W. K. Gladstone, Mr. H. L. Hunter, Lieut.-General W. R. Haliday, Mr. Frederick W. Irby, Mr. Henry Johnson, Staff-Commander J. H. Kerr, R.N., Sir Thomas D. Lloyd, Bart., Commander T. H. Larcom, Mr. Charles Lanyon, Mr. George Loch, Mr. W. L. Lawrence, Mr. J. H. Lance, F.L.S., Mr. John Miland, Mr. Thomas Malby, Mr. W. A. Mackinnon, M.P., F.R.S., Mr. George Moffatt, Mr. A. C. Marzetti, Mr. George Mitchell, Captain D. J. Nasmyth, Mr. James Nichols, Mr. H. A. Nissen, Mr. John Peter, Mr. Thomas F. Robinson, F.L.S., Mr. Arthur E. Scott, M. Emanuel Silva, Admiral E. Saurin, Mr. John George Thompson Colonel W. Tedlie, Mr. Edward F. Teschemacher, Captain H. Hutchinson Walshe, Mr. Edward Waller, Mr. Robert Carr Woods, Mr. T. F. W. Walker, Mr. Charles Wynne-Finch.

ADMIRALTY SURVEYS.*—With undiminished resources the various Marine Surveys undertaken by the Admiralty are making steady progress: this will be seen by the following summary of work performed:—(1) on the shores of the United Kingdom; (2) of our Colonial possessions, and (3) of foreign countries where political relations or the interests of commerce require efficient charts for secure and active navigation.

On the shores of the United Kingdom, Staff-Captain Parsons in H.M.S. *Porcupine* has been mainly engaged in re-sounding the central part of the English Channel, extending from the neighbourhood of Dungeness and the Varne shoal to the Owers: an accurate knowledge of the depths of this area was much needed in the interests of modern navigation, the surveys of the last century being very deficient in detail. Uncompleted work in the River Humber, near Hull, and an examination of the changes at the entrance of Harwich harbour were also brought to a conclusion by this officer and his efficient staff.

During the early part of the year Staff-Commander J. H. Kerr, in a hired vessel, was engaged in the River Shannon and completed a survey of Foynes harbour; towards the close of the working season this indefatigable and skilful officer was seized by illness which speedily terminated fatally; the survey was then transferred to Staff-Commander George Stanley, and the remainder of the season was employed in completing the thorough examination of the shoal ground in the immediate neighbourhood of the Smalls and Bishops Rocks, and also of Ramsay Sound near Milford Haven.

Staff-Commander Hall and his assistant have also completed the re-survey of the upper part of the River Shannon as noted in last year's Address; this elaborate work leaves nothing to be desired by the seaman for navigation or by the engineer for improvement works.

In the Red Sea Commander Wharton in H.M.S. *Fawn*, assisted by Staff-Commander Millard, completed the survey of the Massuah channel, and also determined the relative positions of prominent points of the Hanish islands, in relation to a light-house proposed to be established on the group.

Staff-Commander Millard, on the *Fawn* quitting the Red Sea, returned to Malta to complete the several surveys made in that ship, for official use. During the last autumn (August 1877), this

* By the Hydrographer, Capt. F. J. O. Evans, C.B., F.R.S.

officer, in consequence of representations as to the shoaling of the approaches to Port Said and the resulting obstruction of the fair-way to the Suez Canal, entered on a close examination of the ground, this examination disproved the allegation of a special shoaling, but showed that, as compared with the previous surveys of 1870, 1875, a section from the lighthouse through the 26-foot bank north-west of the light-ship at the entrance, "gives the average rate of deposit at one foot per year, and not localised to particular spots, but is broad in its character, extending over the whole area comprising the approaches to Port Said." The surveying officer found that 28 feet could be carried to within the break-water on the official leading marks.

The survey of the shores of Mauritius and the bank of surrounding soundings, on the scale of one inch to the nautical mile, together with plans of Port Louis and Grand Port, have been completed by Navigating-Lieutenant Coghlan during the present year. This survey, performed with slender resources in two seasons, is to be highly commended for the fulness and precision of its details. The whole work is being prepared for speedy publication.

On the East Coast of Africa Commander Wharton, in H.M.S. *Fawn*, has during the past year resumed his old labours in a thorough survey of the intricate coast-line and outlying reefs north and south of Zanzibar. On the passage from the Red Sea he visited the Abd-el-Kuri islands, and searched, unsuccessfully as it proved, for a rock on which the British steam-ship *Hong Kong* struck in 1875. This casualty, which took place at dawn of day, and resulted in the immediate loss of twelve lives and the total disappearance of the ship, was stated to have occurred three or four miles from the western end of Abd-el-Kuri Island. Commander Wharton found no danger beyond three-quarters of a mile from the land, a very short distance outside shoal-ground charted by the old Indian surveyors.

From July 1877 to February of the present year, the *Fawn* was uninterruptedly employed on the African coast, completing it from latitude 7° s. to 9° s. together with the island of Mafia and the harbour of Kilwa Kisiwari; also, northward of Zanzibar, the harbours and approaches to Tanga, Kisimaya, Manda, and Lamu. The *Fawn* is now refitting at the Cape of Good Hope, and recruiting her ship's company after these arduous labours. Commander Wharton, on the passage down from Zanzibar obtained an excellent series of deep-sea soundings on the line of a projected off-shore telegraph-cable.

In China the seaboard between Hong Kong and Foochow, in relation to reported dangers affecting in-shore navigation, has been diligently examined in H.M.S. *Nassau*, by Captain R. H. Napier and an efficient staff. This duty has included a survey of Haitan straits and the channels leading thereto; of the execution of plans of Liaulu bay, Dodo passage, Amoy, Breaker point, Cupchi bay, the Middle-ground of Foochow River, Snipe island, in Wanchow River; and the rectification in position of several off-lying dangers which had at various times hazarded ships, subsequent to the publication of the preliminary surveys of 1840-46, referred to in the last Address.

H.M.S. *Sylvia*, under two new commanders in succession to Captain St. John (Captain B. W. Bax and Commander P. Aldrich), has been engaged in the past year sounding out the ship channels amongst the group of islands extending some 20 leagues seaward of the south-west part of the Korea, and lying in the direct line of communication between Japan and the northern ports of China; examining the positions of the Kosiki and other off lying islands westward of the southern part of Kiusiu, Japan; and making a survey of the coast between Omai-saki and Irako-saki on the south coast of Nipon. All these surveys are very useful for the increasing commercial intercourse with Japan.

The Surveying Service, in the prosecution of this work, has lost an efficient and excellent officer. Captain Bax, favourably known for his spirited account of service in these waters and in the Eastern Archipelago ('Narrative of the Voyage of H.M.S. *Dwarf*, 1875'), after a few months' command of the *Sylvia*, quickly succumbed to an attack of illness, his constitution having been apparently weakened from long service in the East.

In Newfoundland the survey of Placentia Bay and the development of its manifold and irregular banks and shoals, has occupied Staff-Commander Maxwell and his party for a greater part of the past working season. The remainder of the time at disposal was devoted to a preliminary examination and triangulation of Notre Dame Bay and a survey of the coast-line in the immediate neighbourhood of the mines now being worked on its shores. Discoveries of copper still continue to be made at various localities in the bay, and the increasing importance of this region well warrants the marine survey now undertaken.

In Jamaica the surveying party under Lieutenant Pullen has during the past year completed the coast-line to the westward of

Black river as far as St. John point, including the off-lying bank of soundings; together with large scale plans of Blewfields and Savanna-la-Mer. The resources of this survey have been strengthened by the purchase of the efficient schooner yacht *Sparrow-hawk*.

The Admiralty surveys in progress in the several provinces of Western Australia, South Australia, Victoria, and Queensland are steadily being pressed forward: South Australia and Victoria are approaching completion, and within four or five years South Australia will be well charted.

In Western Australia Staff-Commander Archdeacon and his party have triangulated and charted in detail the coast-line from West Cape Howe to Haul-off Rock—a station about 50 miles to the eastward of King George Sound. An elaborate plan of this Sound and its inner harbour (Princess Royal) has also been completed.

In South Australia the party under Staff-Commander Howard has been partly engaged in making extended plans of small ports and anchorages in newly-opened districts in Spencer Gulf, and otherwise in completing the surveys of Denial and Smoky bays, situated near the western boundary of the province.

In Victoria, aided by the Government steam-vessel of the province, Staff-Commander H. J. Stanley has extended the survey from Banks strait, referred to in last year's Address, to Flinders Island, and included the many off-lying dangers in the neighbourhood. This is a valuable addition to the hydrography of Bass Strait.

In Queensland Navigating-Lieutenant Connor (during the absence on leave of Staff-Commander Bedwell) has been chiefly engaged in sounding the numerous channels and shoals off the coast between West Hill and Cape Palmerston, and making extended tidal observations in Broad Sound.

Lieutenant G. E. Richards, a surveying officer attached to the Commodore's ship in Australia, has completed an elaborate survey of the entrances into Port Jackson on either side of the well-known Sow and Pigs shoal. Extensive dredging-operations in the eastern of these entrances, undertaken by the Colonial Government to render access by the heaviest draught ships to the noble harbour of Sydney, give an immediate value to this marine survey. This young officer has also completed a survey of Elizabeth reef, one of the marked outlying dangers of the Colony, and at which a life-boat with a liberal supply of provisions and water is moored in a secure reef-lagoon, for the relief of shipwrecked mariners.

Steady progress is being made in the marine survey of the Fiji

Islands by Lieutenant W. U. Moore, in H.M. schooner *Alacrity*. The whole of the southern coast of Viti Levu, with its off-lying islets and reefs; and Kandavu passage, the main approach to Savu Harbour (the site of the new capital), are now completed.

During the past year, the Hydrographic department has issued 167 'Notices to Mariners'; and 33 'Hydrographical Notices' have been published, containing 217 pages 8vo.

In addition to the usual 'Tide and Light Lists' one new work, 'The Newfoundland Pilot,' has been published; and revised editions of four volumes of sailing directions issued, viz.: The South and East Coasts of Ireland ('Ireland, Part 1'). Directions from Calais to the Skaw ('North Sea Pilot, Part 4'). Directions for the South and South-West Coasts of England ('Channel Pilot, Part 1'). Directions for approaching the China Sea by way of the Cape of Good Hope as well as by Malacca Strait ('China Sea Directory,' vol. i.).

Apart from the hydrographic information derived from the officers of Her Majesty's Navy on active service in nearly all parts of the globe valuable material has been received from other sources; notably, on the mouth and outer banks of the River Indus, by Lieut. A. W. Stiffe, late Indian Navy; on the coasts of China and Japan, by W. G. Anderson, commanding S.Ship *Conquest*; and by Mr. J. C. Pendred, of the Japanese Government S. Ship *Thabor*.

The new charts and plans published amount to 54, and 1940 charts have undergone correction; 182,000 charts have been printed for Her Majesty's service and for the use of the general public.

ARCTIC REGIONS.—Although there is an evident lull in Arctic enterprise in this country since the return of the *Alert* and *Discovery*, considerable activity is being displayed in various quarters abroad. In the United States, Captain Howgate, who has advocated for some time past a scheme for reaching the Pole by establishing first a Polar colony as a base of operations, seems now in a fair way to see his project carried out. It is expected, indeed, that an Expedition, supported by a grant of 50,000 dollars by the United States' Government, will be despatched for the purpose during the present summer; a Bill to that effect having met with a favourable hearing by a Congressional Committee. The plan is first to found a colony of American seamen in the sheltered quarters of Lady Franklin Bay—i. e. as near the Pole as possible;

and thus inure the party to the rigours of Arctic life, so as to be fully prepared when a favourable season occurs to make a push for the Pole. A private American Expedition, at the cost of Mr. Gordon Bennett, is also talked of as about to attempt to reach the Pole this summer by way of the Spitzbergen seas. But the attention of the scientific public has been chiefly drawn to the bold undertaking that has been for some time preparing in Sweden, under the direction of the well-known savant and Arctic explorer, Professor Nordenskiöld. The object of this new Swedish expedition is no less than the solution of the problem, now three centuries old, of the North-East Passage. A steamer, specially constructed for ice-navigation, manned by officers and sailors of the Swedish marine, and provisioned for two years, will leave Sweden about the beginning of July, and make for the Kara Sea by way of Matotschkin Strait in Nova Zembla. The mouth of the Yenisei is expected to be reached by the middle of August, and, after touching at a trading station here, the voyage is to be continued towards Cape Cheljuskin, the most northerly point of Asia. This is the only promontory along the coast which has not yet been passed by a ship, and this crucial difficulty being overcome, Professor Nordenskiöld anticipates a successful run thence to Behring Straits. Equipped as the Expedition will be with all the resources of modern science, and directed by a veteran Arctic voyager like Nordenskiöld, who has already made three voyages *viâ* Nova Zembla and the Kara Sea to the Yenisei, besides various expeditions to Spitzbergen, it must be conceded that there are here good grounds for anticipating a successful issue. It is true that all previous attempts, including the last one, on an important scale, viz. the Austro-Hungarian Expedition under Weyprecht and Payer, have utterly failed to force the ice which collects at critical points on the route, or to stem the adverse currents; but Professor Nordenskiöld believes it can be done by a steamer, and in one season too, and we are bound to respect the opinion of a man of such extensive Arctic experience. The Expedition, we should add, is fitted out mainly at the expense of Mr. Oscar Dickson, the well-known public-spirited merchant of Gothenburg, who has previously contributed so largely to the cost of similar undertakings. The King of Sweden also bears part of the expenses.

A revival of interest in Arctic matters has this year been witnessed in Holland, where a public subscription has been raised to equip a vessel for a six months' cruise to Jan Mayen Land and

Nova Zembla. Associations and Committees were formed in most of the large towns, and sufficient funds obtained for the Expedition without having recourse to foreign aid, or even to the Dutch Government. The appeal to the public was made on patriotic grounds, the avowed purpose being the erection of some unpretending granite monuments in Nova Zembla over the graves of William Barents and his comrades, the glorious Dutch navigators of the seventeenth century, who perished here in the winters of 1633-34 and 1634-35. But the mission of the little sailing ship, appropriately named the *Willem Barents*, is not intended to be thus limited in its objects. It is stated that the Expedition is to be "an Arctic school for Dutch seamen," and hopes are expressed that it may prove to be but the preliminary to other and more important enterprises. After erecting the monuments to the old explorers, the *Willem Barents* will push on as far as possible towards the north-west from the coast of Nova Zembla; continuing as long as the sea remains open, and returning to Holland before the winter. The Expedition set sail from the mouth of the new Amsterdam Canal on the 6th of the present month.

In my last Address I alluded to the enterprise in which Captain Wiggins has been for some years past zealously engaged, together with German, Swedish, and Russian explorers, viz. the opening up of a commercial route by sea to the mouths of those great Siberian rivers, the Obi and Yenisei. Since then we have had the pleasure of listening to a lecture in this hall by Mr. Seebohm, the companion of Captain Wiggins, when he returned by land to the Yenisei, in April 1877, who gave us a most instructive account of the Physical Geography and products of this great region, accompanied by graphic descriptions of the river scenery, the breaking up of the ice, and the desolate Tundras in their summer dress. Captain Wiggins' ship was unfortunately wrecked at the mouth of the Yenisei; but a schooner built upon the river, which Mr. Seebohm purchased, was afterwards navigated by a Russian crew round Norway to the Baltic.

TURKISTAN: *Russian Explorations*.*—The attention of Russia during the past year has been too much absorbed by war to allow of much progress being made in the peaceful work of geographical inquiry. The pages of her contemporary literature do not therefore contain much information regarding expeditions on foot or in preparation.

* By E. Delmar Morgan.

One of the most interesting journeys lately accomplished in the regions bordering the Russian possessions in Asia is that of the Hungarian Professor, M. de Ujfalvy, to whom I referred in my last Anniversary Address, and who has since returned from his expedition, undertaken for purely scientific purposes. Furnished with letters of introduction from the French Minister of Public Instruction to General Kaufmann and the Russian authorities, M. de Ujfalvy, accompanied by his wife, rode through Ferghana, visiting its chief cities and studying the ethnology of the various races inhabiting it. Ferghana is chiefly known to us through the writings of the late M. Fedchenko. Since he visited it, however, in 1871, important political events have taken place, and the whole of Kokand has finally been placed under Russian dominion. Entering the valley from the west, M. Ujfalvy followed the high road leading from Khojend to Kokand, passing Makhran, the scene of a battle between the Russians and Kokandians, and Bish-Aryk, where the aspect of the scenery changes from the stony desert to the well-cultivated fields. Kokand "the agreeable" is, in our traveller's opinion, the most interesting city of Central Asia. This was the capital of Khudoyar, the last of the independent Khans, and his palace is the finest of its kind. Here, too, are some richly-decorated schools and mosques and a spacious and animated bazaar. In this city, numbering from 60,000 to 70,000 inhabitants, the Russians live peaceably; and the Sarts, forming the trading class in this as in all the other cities of Central Asia, are contented to have exchanged the personal rule of the Khans or Begs for the wise and enlightened administration of their new masters. The Russians have adopted Marghilan as the capital of their new possessions, Kokand having been found unhealthy, and producing goitres. Although one of the oldest towns * of Ferghana, Marghilan cannot be compared with Kokand in the architectural designs of its buildings, or in the animation of its streets or public places. This is the centre of the silk industry, and the foundations of the new Russian town are springing up near the Sart town. The most picturesque point of Ferghana is Vadil, near the entrance to the valley of Shah-i-mardan, one of the seven reputed burial-places of Ali. Not far from here is Kutban-kul, re-named by M. de Ujfalvy, in honour of the distinguished traveller, "Lake Fedchenko." It contains trout, and its water is agreeable to the

* Its antiquity, however, is not as great as Osh, which is said to date from Alexander the Great's time.

taste. Ush-Kurgan was the next place visited. This was the last stronghold of the insurgents in the insurrection of 1876, of which Professor Vambery has given us some account.* It is situated in the valley of the Isfairam, a tributary of the Syr-daria, and commands the best pass into the high up-lands of Alai. M. de Ujfalvy also visited Osh, disposed amphitheatre-like round Mount Takhti Soliman (Solomon's Throne); Andijan, noted for its fertility and mineral wealth; the country between it and Namangan, on the opposite side of the Syr, being termed the *Ek-souarasi*, or Paradise of Kokand. At Namangan, Russian buildings are springing up from the ruins of the Kokandian habitations recently destroyed. At Kassin some remains of historical interest were discovered. This town is inhabited exclusively by Tadjiks, who describe themselves to be the earliest settled inhabitants of the country; that is to say, prior to the Arab invasion. For further details of these interesting travels, as well as for an account of M. de Ujfalvy's journey into Kulja, which, by the way, Russia does not intend to restore to China, if report speaks true, I must refer to the 'Bulletins' of the Paris Geographical Society, where full particulars on the ethnology and archæology of this country will be found.

The Russian Topographical Department has quite recently published a new map of Turkistan, in which are embodied the results of the last Russian surveys on the Alai Plateau. On this map, as I learn from the 'Geographical Magazine,' the Russian frontier-line has been advanced southwards so as to include the Great Kara-Kul Lake, to a point about 80 miles distant from its previous position. Further to the north-east, in the region of Kulja and Lake Issik-Kul, scientific researches have been undertaken during the course of last year by Dr. Regel, of the Imperial Botanical Gardens of St. Petersburg. It may be remembered that our Honorary Corresponding Member Baron Osten-Sacken was among the first to study the botany of the mountainous country between Issik-Kul and Kashgar; and to those who have studied his 'Flora Thian-shanica,' these new explorations of "the Russian Hooker" will be doubly welcome.† Dr. Regel extended his journeys to the region lying south and south-east of the Issik-Kul, almost to the confines of Kashgaria. He visited Kara-Kol, the well-known Musart Pass and glacier, and the lofty syrts or plateaux in which are situated

* See 'Geogr. Mag.,' 1876.

† For particulars, see Dr. Regel's letters published in 'Gartenflora.'

the springs which feed the head-waters of the Naryn, or upper Syr-daria.

As a further result of the Amu-daria Expedition, an interesting Memoir has appeared on the 'Hydrography of the Lower Oxus,' by Dr. Carl Schmidt and F. Dohrandt.* In this are given the different levels of this river at every season of the year, the volume of its stream above and below Khiva, the variations in its course, the quantity and quality of its sedimentary deposits. The tables accompanying it enable us to form a tolerably accurate idea of the quantity of water diverted into canals for the irrigation of the Khanat of Khiva; and the extraordinary fertility of this oasis is explained by the fact that the Amu-daria contains all the fertilising properties of that of the Nile.

Of still greater importance to Geographers are the astronomical observations by F. Dohrandt, fixing the most important points in the delta of the Oxus. These establish in some cases a difference of nearly half a degree of longitude as compared with Solimani's results, upon which the map used during the Khiva campaign in 1873 was mainly based. Thus, while the longitude of Nukus remains unaltered, and Petro Alexandrofsk, Khiva, and Khodjeili, are only a few minutes out of their proper positions, Kushkanatau is 27 minutes, Ak-Kala 28, Chimbai 25, and Klich-Kala 17 minutes too far to the east, according to Dohrandt. The absolute longitude of Nukus was found by chronometer to be 3 hours 58·3 minutes east of Greenwich, and the values of the respective places are reckoned accordingly. For these I must refer to Petermann's 'Mittheilungen,'† from which I have borrowed the above particulars. A further survey of the Amu-daria is stated to have been made last autumn, when the Russian steamer *Samarkand* ascended the river as far as Charjui on the Bokhara frontier. To those interested in the ethnology of Russia I can recommend the perusal of an essay on this subject published in the fifty-fourth *Ergänzungsheft* of the 'Mittheilungen,' from the pen of Dr. Petermann, based on Rittich's large-scale ethnographic map, to which I called your attention in a previous Address.

The work of levelling across Siberia, begun in 1875 and continued in 1876, was finally completed last year by Müller, who is also engaged, as I learn from the 'Academy,' on the preparation of

* 'Mémoires de l'Académie Impériale des Sciences de Saint Pétersbourg,' VII. série, Tome xxv. No. 3.

† 24 Band, 1878.

a popular description of the scenes of travel passed through by the Expedition to Olonek under his late lamented chief, Chekanoffsky, whose valuable work has found an able editor in the Academician F. B. Schmidt, and will, it is expected, shortly appear.

Amongst recent Russian geographical works, we have to welcome the appearance of four new parts of the magnificent work recording the results of the late M. Fedchenko's 'Travels in Central Asia,' edited by his widow. Originally undertaken by the Society of Naturalists in Moscow, this work has been continued under Imperial patronage, and both for its scientific matter and its illustrations may claim rank amongst the best of the kind produced in Western Europe.

MONGOLIA.—The most important Geographical event in Central Asia, and indeed one of the most important Explorations of the year in any part of the world, has been the recent journey of Colonel Prejevalsky, from Kulja to the mythical Lob-Nor and the previously unknown mountain range of Altyn-Tag beyond it. This traveller had already gained a high reputation by his previous journey through Eastern Mongolia, and along the north-western boundaries of China Proper; his most interesting narrative of which appeared in an English translation from the pen of our associate, Mr. E. Delmar Morgan, with a preface and notes by Colonel Yule in 1876. His new journey of Exploration commenced at Kulja in August 1876. With a few Cossack attendants and a Kirghiz interpreter, mounted on camels and horses, he struck across the Tian-Shan range to the south-east, and crossing the two branches of the Yuldus, soon entered the great desert of Gobi, across which the party pursued their toilsome march of some 150 miles, generally near the banks of the Tarim, until they tracked this great river to its termination in the far-famed Lake. The desert around Lob-Nor was found to consist of either barren salt, containing clay, or shifting sand, and was pronounced to be the poorest and most desolate region the traveller had ever set eyes on. Westward a vast expanse of country, consisting of sand-hills, extends as far as Kiria, and eastward a similar desert, under the name of Kum-Tag, continues to Sha-chow. The bed of the Lake extends south, east and west, as an ill-defined expanse of salt-marshes, gradually changing into sandy desert. Strange to say, its water is sweet, but it is choked up with reeds, and is a little better than a morass. Its length is about 65 miles, and its breadth 12.

Some 30 miles south of this Central Basin, which lies 2200 feet above the sea-level, runs a magnificent range of snow-capped mountains, the Altyn-Tag. The range is visible several marches to the northward, rising as an enormous wall 13,000 to 14,000 feet high. Prejevalsky and his party travelled for some distance eastward along its northern slopes, reaching Chaglyk-bulak, at an altitude of 9300 feet, before they found it necessary to retrace their steps. This range forms a magnificent feature in the geography of Central Asia, and its discovery is undoubtedly of the highest geographical importance, as it forms, in all probability, the northern escarpment of the Tibetan plateau, and gives us for the first time a definite idea of the configuration of this vast interior region. The natives report that the Altyn-Tag extends to the south-westward, without a break, to Kenia and Khotan—of its eastward extension they have no knowledge. Ultimately Prejevalsky was compelled to return invalided to Kulja, and we have learnt that it is doubtful if he will be able to return and complete his magnificent discoveries.

The remarkable exploration of which I have just given a brief account, omitting all the zoological and botanical results, which form so essential a part of Colonel Prejevalsky's work as a traveller, forms a welcome continuation eastward of the geographical knowledge which our own explorers, Hayward, Shaw, and the members of Sir Douglas Forsyth's Expedition, Trotter, Gordon, and Biddulph, have gained for us during the last decade in the same region further to the west. At our last Evening Meeting, the admirable description given by Captain Trotter of the mountain ranges and lofty plateaus which shut in, on the north, west, and south, this marvellous central basin of Chinese Tartary, will be fresh in the minds of you all; and I am sure we sympathised with the disappointment which Sir Douglas Forsyth then expressed, on behalf of his party, at the refusal of the Amir of Kashgar to allow his Expedition to proceed eastward, on the very track to Lob-Nor which has now been so successfully followed up by the accomplished Russian traveller.

CHINA.—A journey of great extent, undertaken with a due regard to modern scientific requirements, has recently been made through the Western Provinces of China, Eastern Tibet, and Burmah, by our associate, Capt. W. J. Gill, of the Royal Engineers. This gentleman had previously distinguished himself by an exploration, undertaken like the present one, from pure love of scientific travel, through the

mountainous country of Northern Persia, bordering on Turkomania, and had brought back material which enabled him to construct an excellent map of the region. Being in the enjoyment of leisure and abundant private means, he next turned his attention to China and Tibet. Starting from Shanghai in January 1877, he proceeded up the Yang-tsze to the province of Se-chuen, and struck across this remote part of China northwardly, to the Tibetan frontier. Then, having traversed the northern part of the province in various directions, he crossed into Tibet, reaching Bathang, from which place, continuing southwards, like Cooper in 1869, *via* Atentze, he passed with better fortune than that traveller to Tali-fu, in Yunnan; travelling thence by the long and rugged mountain paths westwardly into Burmah, past the town where Margary was murdered, to Bhamo on the Irrawaddy. Throughout his journey Capt. Gill paid great attention to hypsometrical observations; and in doing so he could scarcely have rendered a better service to the geography of the generally elevated regions which he traversed; our knowledge of the vertical configuration of Western China and Tibet being most imperfect. He was fortunate enough to bring back his instruments in safety, and have them re-tested at Kew Observatory; so that we have now for the first time the means of constructing with considerable accuracy profile sections of some of the most important lines of country in this part of Asia. The paper with which he favoured us on the subject of this exploration, and which contains an admirable description of the country and people of Se-chuen and other regions visited, will be published in the next volume of the 'Journal.'

Another important addition, this year, to our knowledge of the Physical Geography of Central and Western China is Mr. Baber's official Report "On the Route followed by Mr. Grosvenor's Mission between Tali-fu and Momein." The journey of Mr. Grosvenor from Hankow to Burmah, undertaken for the purpose of inquiring into the circumstances of Mr. Margary's death, was carried out in the spring months of 1876, but it is only recently that the present Report, illustrated by a valuable set of lithographed route-maps, has been published by the Government. Throughout the section to which the maps of the Report refer—i.e. from Yunnan-fu to Momein—the journey was made on foot, and observations for latitude taken, whenever practicable, by meridional altitude, in pairs north and south. These serve to check the measurements by dead reckoning, and, with the addition of very numerous hypso-

metrical observations, have enabled Mr. Baber to construct a map on a large scale, filled in with topographical detail, of the highest possible interest to Geographers. A vivid idea of the nature of the country traversed is conveyed by these route-maps, on which, for a distance of nearly 400 miles, the difficult road along which the Mission plodded rarely descended lower than 5000 feet above the sea-level, and in many parts reached nearly 9000 feet. The text of the Report is remarkable for its graphic descriptions of scenery and people, and for the scholarly annotations of Marco Polo which it contains; rarely has an official document been produced so light and racy in style as this. Its practical deductions seem to be carefully drawn, and may be summarized as being entirely unfavourable to the views of those who believe in the possibility of a trade-route on a large scale between Burmah and Western China *viâ* Momein and Yunnan-fu.

BURMAH.—The death, by assassination, of Mr. T. T. Cooper, British Resident at Bhamo, news of which sad event we have recently received by telegraph, has caused profound concern amongst the many friends of this distinguished traveller. His journey through China, *viâ* the Yang-tze and Ta-tsien-loo to Tibet, as recorded in his popular book, 'Travels of a Pioneer of Commerce,' published in 1871, was a bold undertaking which stamped him a man of enterprise, formed of the stuff of which great travellers are made. On returning to England, he read a paper at our evening meeting of March 27, 1871, on the subject of the Chinese Province of Yunnan, which gave rise to an interesting discussion, in which Major Sladen, Mr. Michie, and others well acquainted with Western China and Burmah took part. He subsequently went to India, and endeavoured to penetrate from Assam to Yunnan through the Mishmi country. Of this journey he published an account under the title of 'The Mishmee Hills, 1873.' He was sent out to Burmah in 1872, to accompany the Mahommedan envoys from Yunnan, on their return to their native country after their fruitless mission to England, and was soon after appointed Resident at Bhamo—a post which he subsequently vacated through ill-health, but to which he was re-appointed in 1877. Details of his unfortunate and untimely death have not yet reached this country; all that is known is that he was killed by his own sepoy guards, one of the latter, who remained faithful, falling with him. He had retired from the membership of the Society some months previously.

INDIAN SURVEYS.*—Besides those eminent officers, General Sir Andrew S. Waugh and Colonel Montgomerie, whose services have been noticed in our Obituary record, the Indian Survey Department has lost during the past year another veteran surveyor, Colonel D. G. Robinson, R.E., who was not, however, a member of this Society. Colonel Robinson's name is inseparably connected with one of the earliest and best executed surveys of the Department, namely, that of the hilly and intricate region between the Jhelum and Indus, embracing an area of more than 10,000 square miles. This survey occupied some eight years in execution, and the resulting map is one of the most beautiful ever executed in India. Colonel Robinson's connection with the Indian Surveys ceased some years ago, on his appointment to the important post of Director-General of Telegraphs in India, a post which he most worthily filled up to the day of his death.

The unsparing hand of death has not only fallen on these veteran surveyors, but one of the youngest and most promising members of the Department has been struck down in the execution of his duty. Lieutenant J. E. Gibbs, R.E., was attacked with cholera while at his work in the Ahmedabad district, encamped far from medical assistance of any kind. Unconscious of his critical position, he would not allow his servants to send for the nearest doctor, nor even to inform a friend who was encamped only a few miles off. Colonel Walker, R.E., the Superintendent of the Great Trigonometrical Survey, writes of him that, "though the youngest, he was one of the finest and most valuable of the officers of this Department. Gifted with rare abilities, and with the capacity of turning these abilities to good advantage; full of ardour in the prosecution of his own work, and most willing and anxious to assist others in every way, his death is as much to be regretted in the interests of the public service, and more particularly of this Department, where he was so highly appreciated, as it is mourned in the circle of his family and friends." The Annual Reports of the Great Trigonometrical Survey since 1873-74 contain many valuable papers from this young officer's pen.

In addition to the losses during the year by death of these four distinguished officers who have been so intimately connected with Indian Surveys, the Department has cause to regret the retirement, after a long and honourable career in its service, of Major-General

* I am indebted to Capt. H. Trotter, R.E., for this portion of the Address.

H. L. Thuillier, R.A., C.S.I., who joined the Survey Department more than forty years ago, and has held the superintendence of the Revenue Surveys under the Government of India for no less than thirty-one years; while he has occupied for seventeen years the important post of Surveyor-General of India, an office in which he succeeded the late Sir Andrew Waugh. In the last Annual Report submitted by General Thuillier to the Government of India, the late Surveyor-General points with just pride to the aggregate outturn of the combined Topographical and Revenue Surveys since 1845, which has for the most part been accomplished during his own administration. 493,293 square miles have been mapped by the Revenue Survey, the village lands mostly on the scale of 4 inches to the mile, and the thinly-inhabited hilly tracts on the scale of 1 inch to the mile. The Topographical Surveys since 1860 have executed 291,354 miles of survey, mostly on the 1-inch scale; and during recent years 12,281 square miles have been mapped on the large scale of 32, or 16 inches to the mile. The three give a total of no less than 796,928 square miles, or fully one-half of British India, the latest estimated area of which is 1,473,415 square miles. To those who know the style of work turned out by the Indian Survey (numerous specimens of which may be seen in our Map-Room), it appears marvellous that so much can have been done under the administration of one man, and we trust that the Government will not fail to give some adequate recognition of its appreciation of his merits, and of his long-continued and successful services.

Another officer well known to the Royal Geographical Society as an able and accomplished surveyor and explorer—I allude to Major Godwin-Austen—has also retired from the Indian Service during the past year. His good services in the Kashmir and Ladak Survey, and subsequently in Bhutan, Manipur, and along the Eastern frontier and Assam, entitle him to the gratitude of all Geographers. Both General Thuillier and Major Godwin-Austen have been members of this Society since 1859, and we cordially welcome them on their return to the old country after such long and arduous services.

But although the old names are gradually disappearing, there is, fortunately, no lack of able men to occupy the places the former have so worthily held. On the retirement of General Thuillier the Government have amalgamated the three departments, the Great Trigonometrical, the Topographical, and the Revenue

Surveys of India, and have placed the whole under the new Surveyor-General, Colonel J. T. Walker, R.E., C.B., F.R.S., who has, ever since the retirement of Sir Andrew Waugh in 1861, so ably superintended the Great Trigonometrical Survey, the most scientific of the three departments.

The new Surveyor-General, in a recently-published order, points out that the circumstances which originally led to the formation of the Great Trigonometrical, the Revenue, and the Topographical Surveys as separate departments, acting quite independently of each other, have for a long time past been gradually changing. The great Triangulation has been approaching completion, and for many years a large proportion of the surveyors and higher officers of the Great Trigonometrical Survey have been employed in Topographical Surveying on various scales; both the small, which are required for preliminary survey and reconnaissance, and the large, which are needed for elaborate and detailed survey. The Topographical Department, though originally intended for the execution of the Primary General Survey of India, has also now to undertake surveys on large as well as on small scales. The Revenue Department, which was originally intended for surveying the rich British Districts in the plains of India, leaving the delineation of all hilly country and difficult country generally to the Topographical, has for some years past been largely employed in the topography of hill districts on a trigonometrical basis. Thus the duties of the three departments have become gradually intermixed, and they are daily becoming more so, so that of very much of the work now in progress it is a matter of indifference to which of the three branches of the Department, as originally constituted, the officer deputed to undertake it may belong. The amalgamation now being carried out will enable any officer to be freely transferred from one post or survey party to another, so that he may be employed wherever his services are most required, irrespectively of the branch of the Department to which he was originally appointed.

The amalgamation thus accomplished was obviously desirable in the interests of the public service, and the Government of India are fortunate in having an officer of Colonel Walker's calibre to superintend the working of the Department.

For the last time, then, we proceed to make our annual review on the work performed by the Surveys of India as separate departments.

1. *The Great Trigonometrical Survey.*—Colonel Walker's General Report of the Great Trigonometrical Survey operations for 1876-7,* recently received in this country, is of unusual interest, as, in addition to the progress reports of the ordinary routine operations of the Department, there are many interesting details about the various special scientific inquiries undertaken by the Trigonometrical Survey.

Of these latter the most interesting in their results are perhaps the *Geodetic operations* carried out under the superintendence of Major W. M. Campbell, R.E., and Captain W. J. Heaviside, R.E.; the amplitudes of three arcs of parallel, between Trigonometrical Stations in Southern India, were determined by the electro-telegraphic method; thus completing differential determinations of longitude on eleven arcs between points in Southern India which had already been connected together by the great triangulation.

Some interesting results have been elicited from the comparisons of the electro-telegraphic measurements with those obtained trigonometrically, the trigonometrical values being in almost all cases greater than the telegraphic. This, as Colonel Walker explains, is partly due to the circumstance that the constants for the figure of the Earth, which always have been and are still used in the computation of the geodetic latitudes and longitudes of the Indian Survey, are not quite exact; the most modern and exact investigation of the figure, that by Colonel Clarke, C.B., R.E., of the Ordnance Survey, shows that the differences of longitude corresponding to the trigonometrical distances between points in Southern India should be diminished by about $\frac{1}{8500}$ th part of their magnitudes; a portion also of the excess of the trigonometrical values is due to local deflections of the plumb-line at the stations of observation, and is in accordance with the results of Captain Basevi's pendulum observations, which indicate a probably greater density in the strata of the earth's crust under the beds of oceans than of continents; from this cause the plumb-line at stations on the coast would be deflected from the continent towards the ocean, and this would diminish all astronomically-determined arcs between stations on the coast and those in the interior, and still more diminish the arcs between stations on opposite coasts of the continent.

On the completion of the operations in Southern India, Major

* Printed at the office of the Superintendent of Government Printing, Calcutta, 1878.

Campbell and Captain Heaviside proceeded to determine the differences of longitude between Bombay, Aden, and Suez, in order to complete the connection between England and India, of which the section from Greenwich to Suez had already been executed on the occasion of the transit of Venus in 1874, under instructions from the English Astronomer-Royal. Colonel Walker now gives the final longitudes determined for India:—

	H.	M.	S.	
The Station at Aden	= 2	59	55.89	} E. of Greenwich.
The Observatory at Bombay	= 4	51	15.88	
The Observatory at Madras	= 5	20	59.42	

The longitudes of all places in India are usually referred to Greenwich through the Madras Observatory, the position of which has been determined at various times by astronomical observations. The latest determination of that nature is 5 h. 20 m. 57.3 s. = 80° 14' 19.5" east of Greenwich, which has for many years been the accepted value, and is given in the current 'Nautical Almanacs;' this value is thus shown to be 2.12 seconds of time, or 31.8 seconds of arc, in defect of what may now be considered to be most probably the true value: or, as Major Campbell puts it, "the effect of the season's operations is to remove India, theoretically, about 2000 feet further from England."

Progress has also been made during the past year by Major Herschel, R.E., with the prosecution of the reduction of the pendulum observations made in former years by the late Captain Basevi, R.E., and by Captain Heaviside, with the object of ascertaining the varying attraction in different latitudes and at different heights, but with the somewhat unsatisfactory result, to use Major Herschel's own words, "that the force of gravity (including in that term the attraction of the whole matter of the earth wheresoever situated) as evidenced by the pendulum—remains not wholly explicable by any *known* conditions of the earth's form or constitution. Neither do the observed anomalies point with any certainty to an inference having a high degree of likelihood." Major Herschel points out that pendulum results are subject to errors which we have no prospect of eliminating, and that therefore their *accuracy of observation* should be regulated with regard to the *magnitude* of those errors, and their *frequency of locality* increased both locally and widely; locally, in order to extend our knowledge of the measure of this natural error or uncertainty; widely, in view of the fact that, at present, measures of gravity are the

only kind of measure of a geodetic character which can be extended with any approach to generality over the whole globe.

Tidal Observations.—Colonel Walker gives an interesting chapter on the analysis of the observations taken by Capt. A. W. Baird, R.E., in former years in the Gulf of Cutch, on the West Coast of India. These were reduced by Captain Baird in London, with the assistance and co-operation of Mr. Roberts, of the 'Nautical Almanac' office. Elaborate calculations have been made with the object of determining the influence of variations in barometric pressure, and in the velocity and direction of the wind on the sea-level; but the results obtained are at present only considered to be approximate. Important results may be anticipated from a systematic record of tidal observations at selected points on the coast of India, which the Governor of India is about to inaugurate. The scientific results to be expected from the record has been provided for by the appointment of Captain Baird, an officer in every way qualified for the post, to supervise and control the local observations, and to arrange for their utilisation to the utmost extent possible.

Trans-Himalayan Exploration.—During the year 1876, *the Mullah*, one of the Geographical Indian Survey band of explorers, made a survey of the course of the Indus, from the point where it enters the plain above Attock, to the point where it is joined by the River Gilghit—a distance of some 220 miles—no part of which is distant so much as 40 miles from our own frontier, but which has hitherto successfully defied all attempts at survey. Starting from the Gilghit River at an altitude of about 5000 feet, the Indus winds its way tortuously through great mountain-ranges, whose peaks are rarely less than 15,000 feet in height, and culminate in the Nanga Parbat, a well-known mountain with a height of 26,620 feet. The river in many places is hemmed in so closely by these great ranges that its valley is but a deep-cut, narrow gorge, and as a rule there is more of open space and cultivable land in the lateral valleys, nestling between the spurs of the surrounding ranges, than in the principal valley itself. The Indus emerges into the plains of the Punjab at 1200 feet above sea level.

Colonel Walker reports:—"The positions and heights of all the most commanding peaks in this region had been long fixed by Captain Carter's observations at trigonometrical stations on the British frontier-line; but no European has ever yet penetrated into

it.* Very difficult of access from all quarters, it is inhabited by a number of hill-tribes, each independent and suspicious of the other, who are in a great measure separated and protected from each other by natural barriers and fastnesses. As a whole, the region has never been brought into subjection by any of the surrounding powers. Each community elects its own ruler, and has little intercourse with its neighbours; and with the outer world it only communicates through the medium of a few individuals who have the privilege of travelling over the country as traders. The Mullah possesses this privilege, and thus, in the double capacity of trader and explorer, he traversed along the Indus, and through some of the lateral valleys, leaving the others for exploration hereafter.

“This work done, he proceeded, in accordance with his instructions, to Yassin, marching through the Gilghit Valley, but not surveying it, because the labours of the lamented Hayward, who was murdered at Yassin, have already furnished us with a good map of that region. From Yassin he surveyed the southern route to Mastuj through the Ghizar and Sar Laspur Valleys. This has furnished an important rectification of a route which had hitherto been laid down from conjecture only, and very erroneously; for the road, instead of proceeding in a tolerably straight direction from Yassin to Mastuj, as was supposed, turns suddenly from southwest to north-east at Sar Laspur, which is situated at some distance to the south of the direct line, in a valley lying parallel to the Valley of Chitral. At Mastuj the Mullah struck on to his old survey of the route from Jelalabad, *via* Dir and Chitral, to Sarhadd-i-Wakhan, in 1873, and then proceeded along that route towards the Baroghil Pass, as far as the junction of the Gazan with the Yarkhun River, and then along the northern road from Mastuj to Yassin. This road turns up the Gazan Valley, crosses the Tui or Moshabar Pass—which is conjectured to be probably not less than 16,000 feet in height—and, after traversing a deep crevassed glacier for a distance of about 8 miles, reaches the point where the Tui River issues in great volume from the glacier; the road then follows the course of the river down to its junction with the Warchagam River, a few miles above Yassin.

“Returning to Sar Laspur, the Mullah next surveyed the route

* Several itineraries which were obtained from native information are published in Dr. Leitner's ‘Dardistan,’ and they have been combined together, with considerable ingenuity and very tolerable success, by Mr. Ravenstein, in a map published in the ‘Geographical Magazine’ for August 1875.

to the south-west, up the valley leading to the Tal Pass. This pass is situated on a plateau of the range which connects the mountains on the western boundary of the Valley of the Indus with those on the eastern boundary of the Valley of Chitral, and is generally known by the people of the country as the Kohistan. The sources and most of the principal affluents of the Swat and the Panjkora rivers take their rise in this region, all the most commanding peaks of which were fixed by Captain Carter's triangulation; but of the general lie of the valleys relatively to the peaks, nothing at all definite has been known hitherto. The Mullah has done much to elucidate the geography of this region. On crossing the Tal Plateau he descended into the Panjkora Valley, and traversed its entire length down to Dodbah, at the junction of the Dir River with the Panjkora, where he again struck on his route-survey of 1873.

"It would have been well if he could then have gone down the Panjkora to its junction with the Swat River, but circumstances prevented him from doing so. He therefore travelled along the Havildar's route of 1868 as far as Miankalai, and then surveyed the road to Nawagai and on to Pashat in the Valley of Kunar; and finally, returning to Nawagai, he surveyed the road from there down to the British fort of Abazai.

"Thus the explorations of the Mullah have added much to our knowledge of the geography of the interesting regions lying beyond our northern Trans-Indus Frontier. A good deal, however, still remains to be done before our knowledge of these regions is as full and complete as it should be, and every effort will be made to carry out further explorations as soon as possible."

Accompanying the Report is a sketch-map illustrating the Mullah's explorations, which makes a most valuable addition to our maps of Northern India. A good reduction of this map is given in the 'Geographical Magazine' for May 1878.

Much valuable Trans-Himalayan exploration has also been performed by Mr. E. C. Ryall, who, while in charge of the *Kumaon and Garhwal Survey*, succeeded in crossing the frontier of Chinese Tibet, and by tact and good management was enabled to spend twenty-four days in Hundes, a district lying to the north of Kumaon and Garhwal. During this time Mr. Ryall made good use of his instruments, and laid down with his theodolite the position of numerous distant peaks. His stations of observations, sixteen in number, averaged 17,800 feet in height, one of them being

only a little short of 19,600 feet. Colonel Walker gives us hope that the additional geographical information thus acquired may form the subject of a future Trans-Himalayan Report from the pen of Mr. Ryall.

The operations of the past year have completed the topographical survey of Kumaon and Garhwal, which is a matter of much congratulation. The work latterly has been unusually severe, from the extreme elevation of the country surveyed. Mr. Pocock executed one plane-table section at an average elevation of 16,500 feet, one of the points where he set up his plane-table being 19,000 feet.

Further explorations beyond our frontier were carried out by Lieutenant H. J. Harman, R.E., in the Assam Valley. This officer, accompanied by an escort of 100 men, visited two hill-peaks in the Abar country, and was able to obtain topographical sketches of about 100 square miles of plain country and 300 square miles of hills hitherto unsurveyed. After returning from the Abar country, Lieutenant Harman continued his *secondary triangulation* in the *Assam Valley*, extending for a distance of 53 miles along the banks of the Brahmaputra River to within a few miles of Sudiya. The sides had to be made short in order to minimise the difficulties of line-cutting. The country was very difficult; incessant rains for days not only flooded the nullahs and turned the forest-paths into streams of mud and water, but brought out myriads of leeches; while cane-jungles formed almost insuperable obstacles to laden elephants and bare-legged natives. Lieutenant Harman met magnificent specimens of rubber-trees, and on one of them a station was formed at a height of 112 feet above the ground to connect his triangulation with that of Lieutenant Woodthorpe, R.E., who was carrying on a topographical survey in the neighbourhood. Lieut. Harman was laid up during the season with a slight sunstroke, and towards the end of the season was thoroughly knocked up, and became very ill. Various programmes for further geographical explorations in the hitherto unexplored regions bordering on the Upper Assam Valley have received the sanction of the Government of India; and are, we believe, now in progress of being carried out.

Triangulations in Burmah.—The operations are here carried on in a most difficult country, the hills being flat-topped, densely wooded, and without any characteristic features to distinguish one from another. Many of the surveyors, including Mr. W. G. Beverley—

in charge of the party—suffered severely from illness, and the out-turn of work in consequence falls short of the average.

Eastern Frontier Series, Moulmein.—This triangulation, carried out under the superintendence of Messrs. Rossenrode and H. Beverley, has now reached Tavoy on the parallel of Bangkok, the capital of Siam; and a chain of triangles of little more than 100 miles in length will suffice to connect that important city with the triangulation of India. The distance from Tavoy to Bangkok by sea being over 2000 miles, Colonel Walker points out the value of a direct trigonometrical connection to check or rectify the Marine Surveys which have been carried along the coast-line. The Government of Siam has therefore been invited to allow of the execution of the proposed chain of triangles.

Eastern Sind Series, Meridian 70°.—This series, under the superintendence of Captain Rogers, R.E., has been carried forward a distance of 125 miles over an area of 2455 square miles, and has been prepared for a distance of 98 miles in advance of the final operations. The country is a desert, composed for the most part of parallel ridges of sand of considerable height and with steep slopes covered with thick thorn-jungle. Captain Rogers describes the curious formations known as “Draens,” which occur in this district. These are tracts of many miles in extent where the regular sand-hills disappear, and give place to a variously moulded surface of continually shifting sand, utterly devoid of vegetation. These *draens* are seldom crossed by the natives, and a distance of 5 miles is sufficient for a fatiguing march. Wells are found in small patches of hard soil in the midst of these wastes of sand. In these wells the water is invariably good, although everywhere else it is scarcely drinkable. In one district of about 30 by 40 miles there was a complete absence of drinkable water.

Madras Coast Series.—This triangulation was carried on under the able superintendence of Captain T. T. Carter, R.E., and made good progress in spite of the unfavourable nature of the country, which is flat and contains innumerable groves of valuable trees, and of the famine which was raging in Southern India, and made it extremely difficult to arrange for supplies. Endeavours were made to identify and connect the marks of Colonel Lambton's triangulation in 1800, but unfortunately only one of these could be

found. In the modern surveys care is now always taken to point out and transfer to the local authorities for protection all marks and stones which it is desirable should be kept for future record or use. In the Madras triangulation, under Captain Carter, special precautions have been taken—such as buying and enclosing the small plot of ground containing the Survey Station, wherever it was practicable to do so.

Topographical Survey of Kattywar.—This survey has, as usual, made good progress under Major Ayton Pullan. In Western Kattywar 1700 square miles have been surveyed on the scale of one mile to an inch; 2062 square miles have been triangulated in advance, and 752 linear miles of boundary have been traversed with theodolite and chain. Colonel Walker states that the out-turn of work of all kinds, both in the field and during the recess, is very creditable to Major Pullan, who was well seconded as usual by Mr. J. McGill.

Steps will be taken during the field-season, which is now progressing, to extend the triangulation into Cutch, with the view of commencing the topographical survey of that province.

Topographical Survey of Guzerat.—This survey has been carried on under the orders of Lieutenant-Colonel Haig, R.E., and for a short time under Lieutenant Gibbs, R.E., whose death from cholera on the 21st of November last has been already alluded to. The out-turn of work of all description has been very satisfactory. An area of 1988 square miles was surveyed topographically on the scale of 2 inches to the mile, the British districts in minute detail for publication on the same scale, the Native States in less detail for publication on the 1-inch scale. An area of 2200 square miles has been triangulated and traversed in advance for future topography.

Levelling operations in Guzerat.—These were carried on by Mr. T. H. Rendell, acting under instructions drawn up by Capt. Baird, who was absent in Europe. Mr. Rendell levelled over 358 miles on the usual rigorous system of the Department, *i.e.* with the observers working independently, and checking each other, station by station. Of this, 183 miles was a part of the main line between the Gulf of Cutch and Bombay. The remainder was distributed in branch lines connecting important places *en route*. The heights of 306 permanent bench-marks were determined, several of which were points of the railway and the irrigation systems of levelling, which

have thus been connected together and referred to the same datum as that of the Survey Department.

Computations.—The final reduction of the north-eastern quadrilateral, that section of the Great Triangulation which includes all the principal chains of triangles situated to the north of a line running from Sironj in Central India, through Calcutta to the Eastern Frontier, and to the east of the meridian of Sironj, was commenced in season 1875-76, under Major Herschel, R.E., and has been completed during 1876-77, under Mr. J. B. Hennessey, M.A. Much good work has also been done in the drawing, printing, and photozincographic offices, under the able superintendence of Messrs. Hennessey and W. H. Cole.

2. *The Topographical Surveys of India.*—Under the immediate superintendence of General Thuillier, these have been making the usual rapid and satisfactory progress. Seven parties have been working in Northern India, and two in Mysore. The total out-turn of topographical survey, mostly on scale of 1 inch = 1 mile, amounts to 18,909 square miles, while 22,119 square miles have been triangulated preparatory to detailed survey; and the fair mapping of 20,237 square miles has been completed by the several parties.

Any one interested in the progress of the Indian Surveys should study a map specially prepared by the late Surveyor-General, and which accompanies his Report* for 1876-77, now under review, and which admirably shows at a glance the progress of the Imperial Surveys up to the present time. Many interesting details will also be found in the report of the work performed by the various surveys during General Thuillier's tenure of office.

The Gwalior and Central Indian Survey made good progress under Captain C. Strahan, R.E., 1568 square miles of country having been mapped on the 1-inch scale; in addition to which large-scale maps were made of the Fortress of Gwalior (24 inches to the mile), and the cantonments of Morar. The country embraced in the season's operations was divided into two by the watershed of India, which here runs north-west and south-east. The north-east portion is described as flat and open, with several large towns and villages, and fairly well cultivated. It forms part of the plateau of Raj-

* General Report on the Topographical Survey of India, and of the Surveyor-General's Department for Season 1876-77. By Major-Gen. Thuillier, C.S.I., F.R.S., &c., Surveyor-General of India. Calcutta, 1878.

pútana, and is on an average about 1600 feet above the sea. The change after crossing the watershed is very abrupt. Instead of a fine, open, undulating, and almost level country, the whole surface is intersected by watercourses, which gradually become deeper and deeper, at last forming narrow valleys enclosed by hills, varying from 100 to 500 feet above them. The fall of the country is considerable, as much as 40 or 50 feet per mile. Interesting details about the aboriginal tribes of this region are given in Captain Strahan's Report.

Khandesh and Bombay Native States Topographical Survey.—This party, under the direction of Mr. H. Horst, was divided into two detachments, one being employed on the ordinary 1-inch scale in the native hilly States north of the Nerbudda, and the other on the 2-inch survey of the revenue-paying portions of the plains of Khandesh. The former, of which 1030 square miles was surveyed during the season, includes a wild and hilly tract between the Vindhya Range and the Nerbudda River, the latter (811 square miles) extended along both banks of the Tapti River, between the meridians of 75° and 76° .

Central Provinces and Vizagapatam Agency Survey.—This survey has been brought to a completion during the past season under the orders of Captain Holdich, R.E. No less than 3225 square miles of the north-western portion of the native State of Bustar were topographically surveyed on the reduced scale of 2 miles to the inch. The country was extremely wild, difficult, and unhealthy, and the work was only completed at the cost of much hardship and suffering to all the members of the party.

The area completed by this party since its first formation in the Ganjam and Vizagapatam Agencies of the Madras Presidency, the Orissa Tributary States of Bengal, and in Sambalpur, Raipur, Biláspur, and Bustar, amount to no less than 72,144 square miles. An interesting and well-written account of the district surveyed during the past season is given by Mr. J. A. May.

North-East Division Central Provinces Survey.—The operations of this survey were also brought to a close during the past year under the management of Lieutenant-Colonel Depree, who states in his Report that during the twenty-two years of its existence, the No. 4 Topographical Party had triangulated and mapped, on a scale of 1 inch to 1 mile, a tract of country extending from the high-water

mark of the Bay of Bengal at Balasore to a point 9 miles east of Jubbulpore. This tract extends for 9° of longitude, and, on an average, for 2° of latitude, and its area aggregates nearly 52,000 square miles.

General Thuillier records his high appreciation of Lieutenant-Colonel Depree's industry, zeal, and ability in connection with this survey.

Bhopal and Malwa Survey.—This survey has made excellent progress under the direction of Capt. J. R. Wilmer, 2968 square miles having been finally surveyed and mapped on the 1-inch scale, while the area triangulated in advance of the detail work covers 2864 square miles. Much of the topography, owing to heavy forest, could only be obtained by chain and plane-table traversing, of which 1200 linear miles were completed. Since 1871 this party has surveyed 16,098 square miles, and there yet remains for survey an estimated area of 18,738 square miles. Some details of the country surveyed—through which the forest-covered Vindhya Range passes—are given in reports by Capt. Wilmer and his assistant, Lieut. Gore, R.E.

Rajputana Survey.—This survey is being carried over the Native States of Marwar, Shekawati, and Bickaneer, under the able and zealous direction of Lieut. E. P. Leach, R.E.

Mysore Topographical Survey.—Two parties were engaged in this recently commenced survey of Mysore, under the orders of Capt. Geo. Strahan, R.E. and Capt. McCullagh, R.E.; one in the Nundydroog and the other in Nagar Division. The Nundydroog party triangulated over an area of 5280 square miles, and completed 1465 square miles of topography—a result considered by General Thuillier to be very satisfactory, considering the adverse circumstances under which they laboured. The Nagar division triangulated 4311 square miles, and topographically surveyed 861 square miles. At one time nearly three-fourths of the establishment was on the sick-list. It was originally hoped that the survey of the whole of Mysore, which has an area of 24,881 square miles, might be completed in five years; but owing to the financial pressure caused by the famine, establishments have been reduced to about one-half of the original strength, and with the present establishment, it is doubtful whether the undertaking will be accomplished in twelve years from the time of commencement.

Khásia, Gáro and, Nágá Hills Survey.—This party has for several years been employed in Frontier Surveys and Explorations, and was this year divided into three distinct detachments; Major Badgley, the officer in charge, was employed in making revisions and additions to former mapping in the vicinity of Shillong; two assistants were employed on a boundary survey of the Khásia-Gáro, and Kámrup districts; while Lieut. Woodthorpe and Mr. Ogle were employed in exploring and mapping the wild and hitherto unexamined portion of the Lakhimpur district, s.e. of the military outpost of Sadiya, and s. of the Brahmaputra River. Arrangements have been made for further explorations by Lieut. Woodthorpe in conjunction with Lieut. Harman, of the Great Trigonometrical Survey, who has been mostly employed in the main triangulation of the Brahmaputra River. They are to explore, triangulate, and map the country on the n.e. of the Lakhimpur district, in the vicinity of the Subansiri River, and also subsequently between the Dihang River and the Brahmaputra. This expedition will, it is hoped, add materially to our knowledge of the northern frontiers of Assam and Tibet, which have, as Gen. Thuillier points out, been on three occasions successfully entered by Major H. H. Godwin-Austen; first in 1863 with the Bhutan Mission, when he completed the greater portion of Western Bhutan; in 1864, when he surveyed and mapped 2000 square miles of the Bhutan Duars; and in 1874-75, when, assisted by Messrs. Harman and Ogle, he mapped 2375 square miles of the Daphla Hills, and was the first to define the course of the Subansiri River.

Gen. Thuillier points out, in connection with these recent geographical explorations, that the question of the course of the Great River of Tibet, the Nari Chu, Sangpu, or Brahmaputra, and its channel through the hills into the Valley of Assam, which was for so long a subject of keen discussion between European geographers, is likely to be revived; as Major Godwin-Austen is of opinion that the eastern branch of the Subansiri River, near longitude 94°, will prove to be the Great River of Tibet, which hitherto has been supposed to enter Assam north-west of Sadiya, through the Dihang River.

Gen. Thuillier writes in the highest terms of praise of Major Badgley and Lieut. Woodthorpe, the latter of whom has now, for the third time, been specially selected for survey expeditions beyond the British Frontier. Lieut. Woodthorpe gives a very

interesting report on the Naga Hills * and Lakhimpur Expedition Survey, to which we must refer our hearers for details. The country surveyed was chiefly in the vicinity of the Noa Dihing River, one of the southern tributaries of the Brahmaputra.

It is abundantly evident that the obstacles to be overcome in such work are not inconsiderable. In one place, a range of hills is described as "nearly level along the top, with no commanding points anywhere; it is sinuous, and covered everywhere with tall forest trees, filled in with tangled undergrowth of bamboo and canes, through which we cut at the rate of 300 yards an hour." And again, in another place: "The survey of the river was difficult, as in many places it was too deep for wading and the banks were impracticable at those parts, and we had to resort to rafts in some places where long deep pools lay between precipitous rocky banks, along which, before we constructed rafts, it took us three hours to make a quarter of a mile of way.

Revenue Surveys of India.—The Report on the Revenue Surveys for 1876-77 has unfortunately not yet been received in this country.

ARMENIA: *Mount Ararat.*—The ascent of this famous peak in September 1876, by Mr. J. Bryce, D.C.L., and his account of it in the 'Alpine Journal' for May 1877, have given occasion to a well-timed article in the same periodical by Mr. Douglas W. Freshfield, summarizing all previous ascents of the mountain. These prove to have been more numerous than was supposed, several of those who had accomplished the feat of reaching the summit having published no record of the exploit. One of the most curious circumstances connected with these ascents is the confident disbelief in them all expressed by the Kurds and Armenians who dwell at the foot of Ararat, and Mr. Bryce, in the account he gave us of his journey at one of our recent Meetings, informed us that this incredulity extended even to Russian men of science, who for many years refused to believe in the success of their own countryman, Parrot, in 1829, to whom the honour is now generally accorded of being the first who ever reached the top of Ararat. It is scarcely to be wondered at, therefore, that the positive statements of Kurdish elders and people to Major Stuart and the party of English officers who ascended Ararat in 1856, should have been believed by those

* Published as an Appendix to the Surveyor-General's Report.

gentlemen, one of whom, Major A. J. Fraser, in a letter quoted by Mr. Freshfield, in the article above referred to, says, "I succeeded in reaching the top of Ararat, as did all the party on that or a subsequent day, being the first persons who have done so since the days of Noah." The narrative of Major Stuart, published in vol. xxi. (p. 77) of our 'Proceedings,' gives an account of this ascent in further detail, and states frankly the grounds of the belief of the party that no one had reached the summit before them. Among the successful ascents prior to that of Major Stuart's party, the most important in a scientific point of view was that of Herr Abich, the eminent geologist, in 1845. After two repulses, as he himself records, and being once forced to spend the night buried in the snow at a height of 13,000 feet, he finally reached the top on the 29th of July of that year. It is unfortunate that the fanatical scepticism of the natives should have had the ulterior effect of throwing discredit on the statements of eminent men of science like Herr Abich and others, whom all the world now believes to have really attained the summit.

Beloochistan.—The little-known district of Bashakurd, in the western part of Beloochistan and bordering on Persia, was visited in 1876 by our enterprising young Associate, Mr. E. A. Floyer, during a few weeks' sick leave, whilst engaged in the Persian Gulf Telegraph operations. His paper and map are published in the just-issued volume of the Society's 'Journal,' and form a welcome addition to our knowledge of this part of Asia, following the survey work and the publications of Sir Frederick Goldsmid and Majors St. John and Lovett. Subsequent to this interesting excursion Mr. Floyer made a long journey from Jask to Kirman, Yezd, and Ispahan; and in mid-winter rode from the last-mentioned place across the mountains to Bagdad, surveying the whole route and making observations with the thermometer at 20° below zero. He is now Director of Telegraphs to the Khedive of Egypt.

New Guinea.—A further addition to our scanty knowledge of the interior of New Guinea has been made this year by Mr. Andrew Goldie, a botanical collector, who, as described in a letter to Lord Glasgow, published in a recent number of our 'Proceedings,' succeeded in November last in penetrating some 60 miles inland from the mission-station at Port More-by. Mr. Octavius Stone had previously made an excursion in the same region, a little to the

east of Mr. Goldie's track, but he attained only half the distance of the later traveller. Mr. Goldie crossed the Lalokie River a little below its junction with a tributary, named the *Goldie*, coming from the slopes of the Owen Stanley range to the north-east. Near the coast the country is barren and stony, but further in the interior a number of hills, with sharp ridge-like summits and richly-wooded slopes, become a prevailing feature; and at the furthest point reached the party marched over undulating expanses of rich grassy prairie, varied with woods. Like Signor D'Albertis in his journey up the Fly River the year previous, Mr. Goldie was struck with the paucity of inhabitants in the central parts, and it seems to be no longer doubtful that the interior of this large and picturesque island is thinly peopled. During the journey traces of gold were discovered on the River Goldie, and the tracks of a large animal, which the natives who accompanied the party seemed to regard with great terror. According to Mr. Goldie, the foot-prints were similar to those made by horses' hoofs with shoes on, but with the addition of four toes. In reading this we are reminded of the similar account brought home by Captain Moresby, and the explanation by Signor D'Albertis, to the effect that the tracks are those of the cassowary.

Signor D'Albertis, the indefatigable Italian naturalist and traveller, has made another long voyage up the Fly River during the year. Engaging a small steamer called the *Neva*, and a crew composed of Chinese and South Sea Islanders, he crossed Torres' Strait and entered the mouth of the river on the 21st of May of last year. His voyage was undertaken almost exclusively for the purpose of making Zoological and Botanical collections, Geographical exploration being only a secondary object; his Report, therefore, which appears in the columns of the Australian newspapers, contains but little new information about the river and the neighbouring country. He discovered, however, a large tributary entering the Fly from the north-east. His journey on the river, which continued from May to the end of October, was, from first to last, a series of disasters. Scarcely anything in the annals of travel is more painful to read than his published diary, which is filled with details of troubles with his ill-assorted and unmanageable crew, and with accounts of repeated combats with the courageous savages of the river-banks. The Papuans seem to have been hostile throughout, in the interior as well as near the mouth; and as D'Albertis was afraid of entrusting guns for their defence to his ill-conditioned

and mutinous crew, he had to defend himself with his own rifle, at times against hundreds of the enemy, who advanced in the most determined manner in their canoes, and poured showers of poisoned arrows into the vessel. The crew at length deserted him, first one-half and then the other. The steamer frequently ran aground, and was once attacked by the natives, whilst high and dry upon a sand-bank.

To crown all, D'Albertis first, and then the engineer, fell ill, and the traveller had for some days to drive the engine. Finally the undaunted naturalist had to re-cross Torres' Straits without assistants, except the engineer and a New Caledonian boy. Notwithstanding its painful incidents, it appears the journey was tolerably successful in its main object, a large collection of interesting species having been made far in the interior of New Guinea.

The Rev. W. G. Lawes, the able and zealous member of the London Missionary Society, of whose influence among the natives Mr. Goldie speaks in most favourable terms, has recently returned to England. It is to be hoped that the stores of knowledge regarding the tribes and languages of this part of New Guinea which this gentleman has gathered together during his three years' sojourn will be ere long communicated to the world.

North America.—The survey operations undertaken by various official departments of the United States, to which I alluded, in my last Address, as conspicuous for their breadth of view in the investigation and publication of scientific material of all kinds, have been continued with undiminished energy, and commensurate results.

The first of these undertakings, under the charge of Professor F. V. Hayden (whom we now number among our Honorary Corresponding Members), having completed the survey of Colorado, has extended its operations to Wyoming and Utah territories. The area covered is about 30,000 square miles, between the 107th and 112th meridians, and extending northwards to 44° 15' N. lat. Besides meeting with the usual difficulties attending scientific explorers, operations had from time to time to be suspended, owing to the threatened danger from hostile Indians. Special importance is likely to be attached to this season's work, as, in addition to Dr. Asa Gray, Professor Leidy, Mr. S. H. Scudder, and other distinguished American scientific men, our countryman Sir Joseph

D. Hooker, President of the Royal Society, and General Strachey, accompanied the Expeditionary party on different occasions; so that a more than usually valuable result is to be expected, when the observations of such competent authorities are given to the world.

It has already been noted that the discovery of still existing glaciers in the Wind River Mountains would not be surprising, as remains of huge ancient glaciers were found, and indications of a cessation of their action within a comparatively recent time. No range of mountains in the United States appears to have such accumulated masses of snow as these. Along the western side of the Rocky Mountains in the northern part of the survey, outflows of lava were found to have taken place on a very large scale, great sections of Idaho territory being covered with sheets of basalt that have been poured out in very recent geological times. These and other indications appear to show that the region traversed, however rich in scientific facts (not the least of which is the discovery of a miocene deposit unusually rich in fossil *Articulata*), is not likely to prove of much importance in Political Geography, owing to the desolate and irreclaimable character of the land.

In addition to the field-work of the year, Professor Hayden has published four more thick 4to. volumes, illustrated; a Report of 827 pages, profusely illustrated with maps, sections, views, &c.: the completion of the second volume, and the whole of the third of the Bulletin; and various miscellaneous publications. In these, besides pure geography, the kindred sciences of ethnology, zoology, and palæontology, are ably treated by authorities in these sciences.

Major J. Powell's Survey of the Rocky Mountain Region has been continued in the central portion of Eastern Utah for about 16,000 square miles, between 38° and $40^{\circ} 30'$ N. lat., and $109^{\circ} 30'$ and 112° W. long. The portion explored is an arid and inaccessible plateau, intersected by cañons and gorges. The hypsometric work effected has been found of great importance in the classification of lands and in agricultural industries, on account of the knowledge obtained as to the capability of the various streams being utilised for irrigation. It has also been found that the inflowing water of the Great Salt Lake is one-tenth part greater than formerly; and geological evidence shows that the system of movements by which the mountain ranges of Utah and Nevada were produced have been continued to the present time. Two quarto volumes have

been published by this Survey, discussing the geology and ethnology, the latter of especial value and interest.

Lieutenant G. M. Wheeler (now also one of our Honorary Corresponding Members), of the Engineer Department, U. S. Army, in continuation of his surveys West of the 100th meridian, has triangulated some 12,000 square miles further in Colorado, besides exploring various portions of California, Utah, Idaho, Montana, and New Mexico. Great numbers of valuable magnetic, geological, and meteorological observations have been made by his parties; and the Fellows of the Society have had an opportunity of hearing an account of part of the work done (in New Mexico) from the lips of our countryman, Mr. Goad, a scientific officer attached to Lieutenant Wheeler's party. The chief interest of this Survey lies perhaps in its reference to mining; but amongst other incidental results is a series of sheets, now in preparation, showing the extent of arable, grazing, timber, and other lands, with the direction of drainage, basin perimeters, amounts of rainfall, &c.

Other operations, such as those by Captain W. S. Stanton in the Platte and Captain E. H. Ruffner in the district of the head-waters of the Red River of Texas, may be mentioned; and the publication of two further quarto volumes of the scientific results of Mr. Clarence King's survey of the 40th parallel, of which the field-work was long ago finished, deserves record.

The Survey of the great Lakes and of the Mississippi, under General A. A. Humphreys, has extended its reconnaissances to the west of Lake Erie, with the view of connecting it by triangulation with Lake Michigan. Many soundings and water-level observations have been taken, showing that the mean surface of Lake Superior is 20·5 feet above that of Lake Michigan, and 602 feet above mean tide at New York. The operations on the Mississippi have had a conspicuous effect in the further improvement of the mouth of that river.

The Coast Survey, under the direction of the Treasury, has prosecuted its work with great energy, embracing chains of triangulation on the Atlantic coast from Mount Desert to Cape Canaveral; an extension in Maine and from Cape Florida to the delta of the Mississippi, with deep-sea soundings and temperature observations in the Gulf of Mexico; the determination of heights in the Alleghanies and Blue Ridge Mountains; and a material progress in the survey of Southern California, the Oregon Coast, the Columbia River, and Puget Sound on the Pacific coast. The occupation of

Mount Diablo and Mount Helena, two peaks of the coast range, as westernmost stations of the great trans-continental chain, has cleared at once the interval between that range and the Sierras, with a diagonal of 162 miles, a great step towards the grand scheme of uniting the Atlantic and Pacific triangulations.

CENTRAL AMERICA.—Projects for the canalization of the isthmus connecting North and South America have of late years attracted but little attention in this country, although it was here that those popular discussions of the subject took place, which led to the disastrous survey expeditions of Mr. Lionel Gisborne and others in the years between 1850 and 1857, a record of which will be found in the volumes of our 'Journal' of those dates. In the United States and France, and in the republics whose territory is concerned in the schemes, the subject has never wholly dropped out of sight, and many successive expeditions, national and private, have been engaged in surveying track after track amid the dense forests, in the endeavour to find a practicable route for an inter-oceanic canal. The last of these Expeditions, organised in Paris under the patronage of M. de Lesseps, and commanded by Lieutenant Lucien Wyse of the French Navy, returned last autumn. Its object was to discover a route for a canal, without locks or tunnels, through the southern part of the Isthmus of Darien, where Commander Selfridge, in one of the United States Expeditions a few years previously, had found the most promising ground. Starting in November 1876, the numerous party, having something of an international character, penetrated by way of the Paya River (on the Pacific side), crossing the watershed and entering the basin of the Atrato (on the Atlantic side) by way of the small River Cacarica. It was in this rather circuitous direction that the lowest depression between the two oceans was believed to exist; but Lieutenant Wyse failed to find any saddle in the dividing range lower than 450 feet above the lowest tides. The party subsequently turned northward and explored the valley of the Chuquanaque, here discovering a low pass, between the River Tiati and Port Gandi, which he believed to be the best line for a canal. But the surveys were incomplete.

SOUTH AMERICA.—Mr. C. Barrington Brown, formerly Geological Surveyor of British Guiana, whose interesting description of the Kaieteur Falls of that country, and the marvellous region in which

they are situated, was published in the 41st volume of our 'Journal,' has since given to the world a general account of his journeys in the interior of the colony, under the title of 'Canoe and Camp Life in British Guiana.' He has also published, in conjunction with his colleague, Mr. Lidstone, a narrative of another important survey, on which he has been engaged in the interval between his return from Demerara and the publication of his former work. His last expedition led him up the River Amazons and many of its tributaries, and his party navigated, in the little steamer provided for the service, 15,000 miles of that vast system of inland waters.

A remarkable journey has recently been performed by Dr. Crevaux in the region immediately to the east of Mr. Brown's Guiana explorations. This courageous traveller has succeeded in crossing the Tucumuraque range, forming the water-parting between Guiana and the lower Amazons. This range, though of no great altitude, has hitherto proved insurmountable, and indeed almost inaccessible, owing to the heat of the climate, the density of the forests, and the difficulty of procuring or conveying supplies. Dr. Crevaux has overcome these difficulties, and succeeded in descending the Jary River, flowing from the southern slope of the range to the Amazons.

Further south in Bolivia, another traveller, Dr. Wiener, commissioned, like Dr. Crevaux, by the French Government, has performed the great feat of ascending to the summit of Illimani, the grand snowy peak overhanging the old Inca city of La Paz. He has further established by hypsometrical observations the height of the mountain, proving it to be 20,109 feet. In the ascent he was accompanied by MM. Grumkow and Von Ohlfeld. The height thus given approximates very closely to that ascertained by the enterprising Bolivian surveyor, Muchin, by trigonometrical measurement, the last results given by this gentleman being 21,039 feet. Pentland, the usual authority followed on this point, gave the height as 24,200; but it appears that he stated it in his private correspondence with Humboldt, to be only 21,145.

In Peru, a further contribution to our knowledge of the navigable rivers, remote tributaries of the Amazons near the eastern base of the Andes, has been made by Mr. Werthermon, who made an adventurous and successful descent of the rivers Perene, Tambo and Ucayali, in October and November 1876, publishing a Report and excellent Map of his route at Lima in 1877.

In the extreme south, in Patagonia, Don Francisco P. Moreno, an Argentine savant devoted to anthropological studies, has been making a series of interesting explorations, adding much to our Geographical knowledge, as well as advancing the more special science which he cultivates. In 1875 he visited Lake Nahuelhuapi, situated in an elevated valley of the Andes in Southern Chili. In 1876 he made extensive researches at Chupat and Port Desire; afterwards exploring the River Santa Cruz. He has discovered traces of the existence of a primitive race of men in these regions, quite distinct from their present inhabitants.

AFRICA.—The most important event of the year in connection with African Exploration is the return of Mr. Stanley, bringing with him the news of his discovery of the course of the Congo from Nyangwe to the Yellala Falls. This great exploit brings to a fitting termination a journey which will take rank as one of the boldest and most successful that has yet been accomplished in this prolific field of Geographical enterprise. The chief incidents and results of Mr. Stanley's journey in its successive stages are now sufficiently well known, and the Members of the Society have had the further advantage of hearing an account of them from his own lips in his Lecture of the 11th of February last. It would be superfluous, therefore, to repeat them in this place; and with regard to the more purely Geographical results of his expedition, we are in expectation of learning more from Mr. Stanley himself, in the paper which he is to read at our next Evening Meeting. For the complete details, and for the excellent maps of his route which we learn are in preparation, we must be content to await the appearance of the narrative of his Travels now in course of publication.

Mr. Stanley's journey must exercise a great influence on all future plans of exploration in Central Africa. Whilst circumscribing the area remaining to be explored, and adding greatly to our knowledge of many wide regions previously little known, his successful journey will, on the other hand, no doubt increase the interest of the public in the subject, and supply a further stimulus to Geographical enterprise in the direction of those parts which still continue blank in our maps. For, in spite of the extent of country explored by Mr. Stanley, vast tracts on either side of his line of route, especially along the Congo, remain totally unknown, and will no doubt for years to come attract the adventurous and

afford subjects of speculation to Geographers. We may judge of this by the discussion that has already taken place regarding the identification of the great northern tributary, the Aruwimi, with the River Welle of Dr. Schweinfurth; Dr. Petermann being inclined to adopt the view, originally put forth, I believe, by Commander Cameron (who believes that his *Lowa* is the Aruwimi), that these rivers are one and the same, and Dr. Schweinfurth, in the columns of 'L'Esploratore,' strenuously maintaining the contrary, showing, indeed, from what he and Miani saw of the Welle, that this important stream flows to the north-west, and must form part of the basin of Lake Chad. As far as we at present know, these regions will be for a long time closed against peaceful explorations, owing to the hostility of their inhabitants, and thus many problems of deep Geographical interest will remain long unsolved. The same may be said with regard to the tract of country lying between Albert Nyanza and Lake Tanganyika, where Mr. Stanley obtained a view of the great sheet of water which he named Beatrice Gulf, which, it seems now probable, does not form part of the Albert Lake. The tribes inhabiting this region and the surrounding country to the east and west are at present hostile to all of European race, and it will be long before the Geographical secret it contains—the line of water-parting between the basins of the Nile and the Congo—will be revealed to the world.

From the direction of the Nile little has been done since the journey of Colonel Gordon to Nyamyungo, near Victoria Nyanza, an account of which, with a reduction of the original map, was published in the volume of the 'Journal' last year. One of his officers, however, Colonel Mason-Bey, has recently circumnavigated, by steamer, Lake Albert, and reports that he has fixed by astronomical observation the position of the south-eastern and south-western corners of the Lake, showing that it terminates in $1^{\circ} 11'$ lat. N. of the Equator, and is a much smaller sheet of water than had previously been supposed. If these conclusions be correct, and we learn from Colonel Gordon himself that Mason-Bey is a trustworthy observer, the interval between Lakes Albert and Tanganyika will be much wider than appears in our maps. But it is necessary to say that Sir Samuel Baker calls in question the latitudes of Colonel Mason-Bey, at least those taken at the southern end of the Lake, and believes that it stretches much farther to the southward than this officer reports. It will probably not be long before further surveys will be undertaken to set at rest this

disputed question. It is interesting to learn that the natives reported to Colonel Mason-Bey the existence of several lakes in the unexplored region to the south of the Albert; but the true southern shores of this lake, masked as they are by shallows and marsh vegetation, have not yet been definitely traced. The Report of Mason-Bey formed the subject of a sitting of the Khedivial Geographical Society at Cairo, on the 17th of February last, and is published, with maps, in the 'Bulletin' of the Society, No. 5. The judicious remarks on the occasion made by the Vice-President, General Stone, himself an able Geographer, are published in the same number.

According to the latest news from the Upper Nile, another traveller, under Colonel Gordon's auspices, has started for a long journey through the Equatorial Lake Regions. This is Dr. Emin Effendi, who had already, in August 1877, reached Mruli, marching thither from Magungo on Lake Albert, and had passed a month with the powerful chief Kaba Rega. His plan was to continue his travels southward to Uganda and Karagwé.

Remarkable progress has been made by the courageous leaders of the Church Missionary party which was despatched to Victoria Nyanza in 1876, in consequence of Stanley's report of the willingness of King M'tesa to receive Christian missionaries. Doubts of M'tesa's peaceful tendencies led the directors of the Mission to prefer commencing with King Rumanika of Karagwé, of whose friendly disposition towards Europeans there was less doubt. It was with the intention, therefore, of visiting King Rumanika that the party, arriving at the south shores of the Victoria from Zanzibar, launched their boat on the waters of the Lake; but their plans were changed by the arrival of messengers from King M'tesa with a friendly invitation, and at the end of June last, Lieutenant Shergold Smith and the Rev. Mr. Wilson set sail from Ukerewe Island for Uganda. From the north shore of the neighbouring island, Ukara, they sailed straight across the Lake, with a fine breeze, accomplishing the voyage of about 100 miles in a day and a night. They were received with great cordiality by the King, and a mission-station was immediately established near the royal residence. Lieutenant Smith re-crossed the Lake for other members of the Mission and for the dhow which he had left in course of construction at Ukerewe. The good fortune which had hitherto attended his efforts here forsook him. A misunderstanding with the chief of the island led to hostilities and the massacre of the

whole party; out of some eighty persons, including the Arab trader Sungoro, only three escaped. This deplorable event, which was preceded by the wreck of the dhow, will probably interrupt for some time the promising route to Uganda from Zanzibar, across the Victoria, which had been thus successfully opened; but we are assured that the missionary work at Uganda will not be discontinued, and that a reinforcement for Mr. Wilson's Mission is now on its way *via* Egypt and the Nile. Later intelligence, however, has been received, to the effect that Mr. Wilson has found it necessary to quit King M'tesa and has returned to Unyanyembe.

Nearer the East Coast, at Magila, in the picturesque country of Usambara, a station has been founded by members of the Universities' Mission, and advantage has been taken of the opportunity thus afforded by the Rev. Mr. Farler of the Mission to construct a map of the country, thereby making an interesting addition to our Geographical knowledge. A little further to the north, Dr. Hildebrandt, the well-known botanist, has made an attempt to reach Mount Kenia, from Mombaz, as Krapf had done before him, but was obliged to turn back, through the cowardice of his attendants and the alarming rumours of hostile natives in advance. The Rev. Thomas Wakefield, of the Ribé Mission, in the same region, has been making a tour in the Galla country, across the River Dana.

The attempt to establish a bullock-waggon route to Unyanyembe and Tanganyika has for the present failed, to the sincere regret of all who are interested in African exploration and civilisation, which the success of this new mode of travelling would have tended so powerfully to promote. The cause of the death of the oxen has been definitively ascertained by Dr. Kirk to be the tsetse fly, which he has proved, by specimens sent to him by a member of the missionary party, to be abundant in several places on the road. The Expedition, however, is pushing forward towards Ujiji, in spite of the losses and the delays it has encountered.

About 20 miles south of Zanzibar, at the excellent sea-port of Dar-es-Salaam, a work of another nature is in active progress, viz. the construction of a road by English engineers, with the full authority and sanction of the Sultan of Zanzibar. Of this highway, destined to aid materially in the opening up of East Central Africa to commerce and civilisation, by connecting the northern end of Lake Nyassa with a desirable port on the East Coast, 30 miles have already been completed, according to the

latest information. A project has been for some time under the consideration of the African Exploration Committee to send a small, but well-organized, Expedition to explore the country from the end of this road to Lake Nyassa, and thence to the south end of Tanganyika: to this I shall have occasion again to refer in the Conclusion of my Address.

In the important section of Central Africa of which Lake Nyassa may be considered the centre, further additions to our knowledge have lately been made by parties connected with the various British mission stations, of which there are now three in this region, belonging respectively to the Scottish Free Church, the Established Church of Scotland, and the Universities' Mission. The Established Church of Scotland has founded a Mission Station called *Blantyre*, 3000 feet above the sea, in the highlands east of the Shiré River, three days' march from Lake Shirwa, and two days from the point on the Shiré, where navigation recommences above the falls. The Free Church steamer *Ilala* has been employed in cruises towards the north of the Lake, and members of the Universities' Mission have travelled from the East Coast to the residences of the inland chiefs, towards the head-waters of the Rovuma. The same Missionary Society has now indeed a settlement at Msasi, in the interior, north of the Rovuma, from which Mr. Beardall, in August to October last year, made a journey to Mwembe, the chief town of the powerful chief Mataka, near the eastern shore of Nyassa. This part of Africa may be said now to be fairly well known, although, of course, much remains to be done in districts away from the lines of travel. As a proof of the rapid progress of events and the important practical results which follow Geographical exploration, I may mention that a party of enterprising Englishmen are now preparing to place on Lake Nyassa one or more large sailing-vessels for the purposes of trade and opening up the country. The ships will be constructed at Quillimane, and taken in sections to be rebuilt on the shores of the Lake. Experience has shown that larger vessels are required on this stormy inland sea than the small steamers and steel boats which have been used hitherto.

A large tract of previously unknown country, to the north of the Lake, has quite recently been traversed by an Expedition with more purely Geographical aims, under the late Captain Elton, our Consul at Mozambique. We have recently had the pleasure of listening in this Hall to an account of this interesting journey, from Mr. H. B. Cotterill, who formed one of the party. Landing from the

missionary steamer on the northern shores of Nyassa, the Expedition, consisting of Mr. Cotterill and three other Englishmen, besides the leader, struck across a mountainous country which closes in the Lake basin on the north, and, overcoming the serious obstacles presented by the hostility of warlike tribes, succeeded, after a long and toilsome march nearly due north, in reaching the Ujiji and Zanzibar caravan road, at Usekhe, in Ugogo, where the gallant leader of the band died of sun-stroke. In him the public lost a valuable servant, and African Geography an intrepid explorer. The remainder of the party continued their journey to Zanzibar. By this bold exploit another of the great blanks in the map of Central Africa has been scored through, and a great accession made to our Geographical knowledge. The party crossed, in their northerly march, the upper Rufiji, or Ruaha, as Speke named it on his map; and the newly-explored line, added to those further west traversed by Livingstone and Livingstone's followers, and the recent naval surveys towards the mouth of the Rufiji, place us in possession of a fair general knowledge of the leading features of this part of Africa.

On the West Coast we hear of the recent despatch of a pioneer party to San Salvador, near the Congo, by the Baptist Missionary Society, and of preparations made, under the auspices of the Church Missionary Society, to send a steamer towards the head-waters of the Binué affluent of the Niger. At Hamarua, on this river, as we were informed by Bishop Crowther, native traders are sometimes met with who have traversed the whole blank expanse of Equatorial Africa lying between the Upper Binué and Lakes Albert and Tanganyika. The navigation of the river by the missionary steamer presents, therefore, a favourable opportunity for securing a basis for an entirely new field of exploration, and the African Committee have reason to be grateful to the Church Missionary Society for having offered a passage on board their steamer to any explorer that may be sent out by the Committee.

Such is a brief summary of recent African enterprises on the part of our own countrymen. But other European nations have also been active in the same field; and the preparations that are being made in some quarters give promise of further explorations on a very considerable scale. Thus we hear of the amalgamation of the two German Societies—the new one formed to co-operate with the Belgian International Commission and the older Society for the exploration of Central Africa; the united Society having,

we are further informed, added practical commercial objects to its programme, and obtained from the Government a grant of 5000*l.* in aid of its operations. One traveller, Herr Schütte, has already been sent out by the Society, with the object of penetrating to the capital of the Muata-Yanvo, and news has recently been received of his arrival at Loanda.

The German papers announce that Hermann Soyaux, the botanist of the German Expedition to the Loango coast, 1873-76, will set out in July or August on another expedition to Equatorial Western Africa, to explore the Gaboon and Ogowé country in the interests of natural science, and at the same time, under the patronage of the Hamburg firm of Wörmann, to make experiments with a view to the starting of plantations. A long account of Herr Soyaux's travels in Loango and Angola is about to appear, published by Messrs. Brockhaus.

The Expedition despatched by the Belgian Commission to establish stations and undertake explorations on Lake Tanganyika and beyond, reached Zanzibar at the close of last year, but met there with a serious calamity in the loss by death of its two principal members, MM. Crespel and Maes. This untoward event, by which two more valuable lives have been added to the long list sacrificed in the cause of African scientific and philanthropic enterprise, has caused, however, no delay in carrying out the objects of the Expedition, and two other officers were promptly selected in Belgium to fill their places, while the rest of the party made a preparatory trip into the interior. We now hear that the two officers, MM. Wautier and Dutrieux, have arrived out, and that M. Cambier, the chief, was preparing for a final start at the end of May. M. Marno, one of the original party, has left, and is now on his way to Europe.

The Portuguese Expedition, so munificently supported by its Government, is now well on its march towards the interior. The area of country chosen for its operations is that which includes the head-waters of the three important streams—the Zambesi, the Kassai, and the Cuñene. The starting-point of the expeditionary party was Benguela, which it left on the 12th November last, and it has already been heard of as far advanced in the direction of Bihé. Besides fixing accurately the latitude and longitude of places, the Expedition makes observations in meteorology and terrestrial magnetism, and takes photographic views on the way.

The French Expedition under M. de Brazza on the Ogowé, as is the fate of most Central African undertakings, has met with many difficulties and delays. One of the party, M. Marche, has been compelled to return, invalided, to Europe, leaving M. de Brazza and Dr. Ballay at Doumé preparing to ascend to the falls of Poubara. In its upper course, it is remarked that this river bends more and more to the south, giving rise to the supposition that it may be an arm of the Congo. Many problems in the Geography of Central Africa will be set at rest if the journey about to be undertaken by Lieut. de Semellé proves successful. This enterprising officer is about to explore the great blank in Central Africa lying between the Congo, the Albert Nyanza, and the southern tributaries of the Niger, by ascending the latter river and proceeding by land along the south bank of the Binué to its upper waters, and thence striking across the unknown regions towards the Equatorial Lakes. He set sail from Bordeaux on the 5th April.

A still more important Expedition has been recently prepared in France, having for its object, in emulation of Cameron and Stanley, the traversal of the entire continent, from the coast near Zanzibar to the mouth of the Congo. It originated quite independently of the French African Committee, which has scarcely yet completed its organisation, and is supported by the French Government, the Chamber of Deputies having in February last voted a sum of 100,000 francs for its support. The leader, M. l'Abbé Debaize, is spoken of as most thoroughly qualified for the enterprise he has offered to carry out, and which is to be purely secular and scientific in its aims. He set sail for Zanzibar on the 21st of last month. A large scheme of Roman Catholic Missions in Central Africa, quite independent of l'Abbé Debaize's journey, has been elaborated at the same time, and we hear that nine missionaries left on the same date as this traveller, for the purpose of founding the new stations on the shores of the great lakes Tanganyika and Victoria and Albert Nyanza. These Central African Missions, it is stated, are simply an extension of the work of the *Société des Missionnaires d'Alger*, founded ten years ago by the Archbishop of Algiers, and which has already twelve mission-stations among the Kabyle and Arab tribes of the Sahara. The missionaries now on their way to Central Africa are all young men, thoroughly acclimatized, and familiar with Arabic. both written and spoken.

This recent action of the French makes the third instance of European Governments contributing directly to the costs of African

Explorations:—the Portuguese; the German; and the French: all by parliamentary votes. The Italian Government also, through the Minister of Public Instruction, has subscribed a sum towards the National Fund for the Antinori Expedition, which had for its object the exploration of the wide tract of unknown country lying between Shoa and Victoria Nyanza. This important Italian undertaking has also met with great obstacles, arising from the unsettled state of the country and the opposition of the Galla tribes. One of the members, Captain Martini, has returned to Europe, with scientific collections made by the Expedition. Happily the report of the death of Marquis Antinori has proved to be a false rumour; the chief, together with Signor Chiarini, being, on the departure of Captain Martini, on the eve of starting from Shoa southwards. Another Italian Expedition, organised independently, is now on its way to Shoa. It has for its leaders Signors Gessi and Matteucci, and is proceeding by way of the Nile and Kaffa to Southern Abyssinia.

Conclusion.—In my last Anniversary Address I called your attention to the nomination of an African Exploration Fund Committee, for the purpose of promoting the efforts making in so many quarters to open up the interior of Africa to civilisation and commerce by the prosecution of further researches and explorations as to the Geography of the Central regions more especially.

The Report of that Committee is now ready to be presented to the subscribers, and I am glad to be able to announce, in anticipation of further details, that the Committee have come to the resolution to recommend the despatch of a carefully organised Expedition to explore the country lying between the caravan-road, now constructing from Dar-es-Salaam (a few miles south of Zanzibar) and the northern end of Lake Nyassa; and should the Expedition thus planned reach that goal successfully, and adequate funds are available, it is contemplated to push on exploration to the southern end of Lake Tanganyika, a further distance of 190 miles, thus completing approximately Nos. 3 and 4 of the Routes originally proposed in the Circular issued by the Committee. The Council, in view of such renewed effort to obtain valuable Geographical information, have voted for this year a further grant of 500*l.* to the Exploration Fund. With such additional aid, and what subscriptions may be received from the public and subscribers, the Committee feel that they may confidently undertake to set on foot, without further loss of time, the proposed Expedition.

It now only remains for me, on my retirement from the office of President, to congratulate the Society on the choice which has fallen upon the Earl of Dufferin for my successor. Distinguished alike as a Statesman and a Scholar, and no less generally known as a traveller and an accomplished man of the world, with all the qualifications of a great administrator and ruler, I could not desire any better fortune for the Society or myself than to resign my trust into such hands. In Lord Dufferin's keeping we shall feel assured that the character and usefulness of the Society will not only be perfectly safe, but the Society itself receive new lustre from the association of his name as its President.

par M. Belgrand et G. Lemoine (*The Meteorological Society of France*). Registrande der Geographisch-statistischen Abtheilung des grossen Generalstabes, viii., part 1 (*The Chief of the Prussian General Staff, Geographical Section*). The Franco-German War, 1870-71, 2nd pt. 11th Section, translated by Capt. Clarke (*H. M. Secretary of State for War*). Report by Mr. Baber on the route followed by Mr. Grosvenor's Mission between Tali-fu and Momein (*H. M. Secretary of State for Foreign Affairs*). And the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM FROM MAY 13TH TO JUNE 3RD, 1878.—Admiralty Charts, 3 sheets. Atlas of Pilot Charts for the Atlantic Ocean (*The Hydrographer*). United States Charts, 1 sheet (*Commodore R. H. Wyman, U.S.N.*) Map of the Colony of the Cape of Good Hope (*The Government of the Cape of Good Hope, through the Crown Agents*).

ANNOUNCEMENT OF THE MEETING OF THE SUBSCRIBERS TO THE AFRICAN EXPLORATION FUND.

The CHAIRMAN announced that the African Exploration Fund Committee having made their Report for the year to the Council, a meeting of the subscribers to the Fund would be held in that Hall on the 14th inst. at 3 o'clock. He trusted that all those who took an interest in the further exploration of Africa would attend. The Report was very short, and a very simple one, a printed copy of which would be sent to all the subscribers to the Fund. It recommended that a carefully organised Expedition, of a very limited character as to its *personnel*, should be sent at once to pursue explorations from an excellent port a few miles south of Zanzibar towards the north end of Lake Nyassa, and from thence to the southern end of Tanganyika, in order if possible to establish the practicability of a line of communication between those two great lakes. There were two objects that all who were desirous of promoting civilisation and commerce in Africa were much interested in; the one was to establish a caravan route from the east to the west, right across the line of the great inland seas; and the other a line of communication from north to south, from the sources of the Nile to the mouth of the Zambesi. Of course it was hoped that ultimately both directions would be explored, and tolerably good caravan routes established.

The Society was to be favoured that evening with a Paper of a purely geographical character by Mr. Stanley, describing the geographical results of his three years' exploration from the eastern coast to the west. There could not be the slightest doubt that the information he had to give would be as instructive, as it would certainly be novel.

A Geographical Sketch of the Nile and Livingstone (Congo) Basins. By H. M. STANLEY.

It is almost impossible within the short time allotted to a reader of a paper to give more than the most meagre outline of the

geography of a continent, and I do not propose to attempt it, but what I have been able to write in the few hours of leisure secured during the last four or five days I hope will be sufficient for this evening.

As Central Africa rises exhumed from its oblivion of 6000 years, we find, to our wonder and delight, that it possesses stupendous mountains, grand rivers, and lakes of great extent; that it is as prolific, as rich in valuable vegetation and metals, as other continents.

We have discovered that from the Indian Ocean the continent slopes upward for about 100 miles toward the west, until it reaches the base of a mountainous ridge, which, like a dyke or wall, extends from the Mokattum Mountains down the east coast as far as the Cape of Good Hope, and sweeping along the southern end of Africa, runs up north along the west coast as far as the Senegal River. North of the Senegal there is a sudden subsidence, and at the north-west it rises again in the Atlas Mountains. At the eastern termination of the Atlas commences another wide break in the mountain wall, and it extends along the whole length of Tripoli, and across Egypt to the Mokattum Mountains. Or, in other words, supposing we ran an inner line, following the mountain ridges which conform to the coast and nearly surround Africa, we should have a length of 13,500 geographical miles; 2500 miles of this length is occupied by the breadth of the two gaps, and 11,000 miles by the mountain rim or wall which incloses the interior.

The eastern rim has been pierced by several rivers of considerable volume, all of which debouch into the sea south of the Equator. Arranged according to their magnitude, they are the Zambezi, Jub, Limpopo, Rufiji, Pangani, Osi, Wami, and Kingani.

At its south end, the mountain rim is comparatively intact. On the west coast it is penetrated by the Livingstone, Niger, Orange, Senegal, Gambia, Ogowai, Gaboon, Kwanza, and Kunene. The only river of any importance that issues into the northern sea is the Nile.

This enormous *enceinte* varies in altitude from 3500 to 19,000 feet above the ocean. On its sea front it either descends in narrow terraces and cliffs, or with precipitous slopes; inland the inclination is very gradual, and its subsidence small.

But, beginning our rapid sketch as the late Anglo-American Expedition began its march, on leaving Zanzibar Island we cross a channel about 25 miles wide, and arrive at Bagamoyo, one of the Seyyid Barghash's ports on the eastern coast of Africa. A journey

of 12 miles enables us to traverse the breadth of the African territory of his Highness the Zanzibar Prince, and also to cross the Kingani River. The westernmost outpost is guarded by a corporal's guard of Baluches stationed at Kikoka. Thence a journey of about 80 miles in length, over some lovely park land, brings us into the valley of the Wami, which debouches into the sea between the east coast ports of Whindi and Saádani. In the dry season the Wami at the ford is about 40 feet wide and 3 feet deep. Granite boulders here and there show themselves, so that this river is apparently unsuitable for navigation. Crossing the Wami, the journey is continued across the streams which supply it from the north-west, and we are soon skirting the great natural mountain wall above mentioned in the country of Nguru. Arriving at the Mkundi, a tributary of the Wami, we enter on the other side Usagara. From the Mkundi we rise from a height of 1900 feet in three marches, or a distance of 30 miles, to the pastoral basin of Kitangé, which is at a height of 3500 feet above the sea. The route leads by peaks, cones, and extremely beautiful scenery, and numerous crystal clear streams are frequently crossed, flowing southwards to the Mukondokwa, which is the name by which the Wa-Sagara know the Wami.

From the basin of Kitangé we rise over one of the mountains which bound it to the west to the height of 4500 feet, and soon after behold a plain-like prolongation penetrating deeply into a mountain fold. Descending the westerly slope, we find ourselves in a game country, haunted by several noble species of animals. A twenty-three miles' march brings us to Tubugwé basin, which contains a large collection of villages, and 12 miles beyond, westerly, is Mpwapwa, which since I first arrived there has rapidly come into prominence. This place is about 3500 feet above sea-level. The mountain chain and the maritime region, which, extending from Bagamoyo to the eastern base of the mountain chain which extends along Eastern Africa, are now east of us. We find ourselves looking down upon one of those narrow plains which penetrate from the westward into the western flanks of the East African mountains. This plain is a prolongation of the wilderness of the Bitter Water, or, as the natives term it, the Pori M'arenga Mkali. A few miles west of Mpwapwa we arrive at Chunyu, where the bitter nitrous water which gives its name to the wilderness is found. Chunyu is the westernmost settlement of the country of Usagara.

Between Usagara and the next country, Ugogo, stretches the wilderness, about thirty miles in breadth towards the west, over

a degree to the south, and to an unknown distance to the north. It is an uninhabitable and waterless track covered with blue-gum, dwarf thorn-trees, and towering baobab.

Ugogo extends west from the borders of the wilderness about 70 miles. It is a land of trial and tribulation to travellers who have anything better in view than the exploration of this miserable country. I have seen it in the rainy and the dry season, but I must confess I felt happier out of it than in it. Not that there is any danger to be apprehended, but the natives, though by no means hostile, subject the traveller to many annoyances, out of, I believe, sheer wantonness. But it must be stated to their credit that to strangers or foreigners sojourning with them they are hospitable enough. Another reason, perhaps, for the dislike which travellers entertain to Ugogo is that the annoyances which they endure from the natives come at a period when the evil climatic influences begin to torture them with fever, debility, dysentery, and many other diseases.

To the north of Ugogo is that indefinite country called the land of the roving Wahumba, or Masai, extending from the neighbourhood of Usagara in a north-west direction to within a very short distance from the Victoria Nyanza. It will probably be the last land to be explored throughout, as the natives are of that same warlike stock which has kept its mountain-chains, its plains and rivers, west of the Jub River, up to the present time unexplored. South-west of Ugogo is Urori, a large pastoral country inhabited by a brave people who are not indisposed to travellers, but who unfortunately have come lately into collision with Arab traders. To the south lies the land of the Wahehé, or Wadirigo, a fierce and marauding tribe who torment the Wagogo herdsmen frequently by their forays.

The road which I adopted on this last expedition is along the watershed which separates the northern feeders of the Ruhwha, or Rufiji, from the periodical watercourses which trend to the trackless land of the Wahumba north.

From a level plain 2800 feet above the sea, which in the dry season becomes a mere salina, we rise to a higher terrace having a steep eastern front, and rising 1000 feet above the plain of Mukondoku, in Ugogo. After surmounting this terrace we begin to distinguish that vegetation which is characteristic of Unyamwezi, Ukawendi and Ukonongo. The Myombo-tree especially marks this, replacing the acacias of Ugogo, in forests of exceedingly graceful and useful timber. Large fragments of ironstone rock, sheets of gneiss denuded of soil, and a succession of ridges, the

eastern sides of which are very steep, often precipitous, while the western sides have gentle slopes, are other notable characteristics.

Edging to a little west of north, after a journey of 70 miles, we find ourselves in the country of Urimi, at a height of over 5000 feet above the sea. The wooded regions south of Suna, the southernmost village of Urimi, constitute the water-parting between the stream-courses which trend from the north-west towards the Rufiji and the east Malagarazi, and those which are the head Nile-streams. Looking north, we see the land disposed in blunted cones and ridges and great heaving swells, between which the rillets hurry from all points to form the infant Nile. We find that our road to Ukerewé lies along the valley of this river for a distance of 42 miles, by which time in the basin of Vinyata in Ituru it has obtained the respectable volume of 3000 cubic feet of water per second. It is here called the Mwaru, a stream 10 yards wide and 10 feet deep, with the current of a true mountain-torrent. This, of course, after rain.

After traversing an uninhabited forest land, we arrive at Mgongo Tembo, or the Elephant's Back, so called after an enormous lump of granite rock. The chief, Malewa, informs us that the Mwaru River is now called the Leewumbu, and that it flows north-westerly south of his country. On continuing the journey we cross several small streams trending south-west, no doubt to the rapid Leewumbu. Twenty miles from Mgongo Tembo we arrive at a point whence we observe a spacious plain, which is called Luwamberri. After a descent of over 800 feet from the uplands we arrive upon what in ancient times was an arm of the Victoria Nyanza. It extends northerly towards the lake, and is intersected by sluggish ditch-like creeks, and is about 40 miles wide. Near the middle is the shallow watercourse which gives the name to the plain. The grass for about a mile on either side lying level with its tops towards the north proves that in the rainy season the Luwamberri supplies a vast quantity of water to the Nyanza. In the centre of the plain rises an island-like elevation, which on exploring I found to be the resort of numerous herds of game of all kinds. The game was at this time feeding west of the Luwamberri, and consisted of giraffe, zebra, gnu, buffalo, spring-bok, water-buck, kudu, hartebeest, wild boar, and several varieties of smaller antelope; while birds abounded—ibis, fish-hawks, kingfishers, spur-winged geese, ducks, vultures, flamingoes, spoon-bills, and cranes.

A few days' journey from the Luwamberri River brought us to the south-east corner of the country of Usukuma, where we revelled in plenty. Provisions are always cheap and abundant; the natives,

disturbed by that phantom of Central Africa, the ubiquitous Mirambo, were always ready to fight us or serve us, which shows what admirable people they are. As we preferred them for our servants, our intercourse with the natives was of the most friendly character.

From this south-east corner of Usukuma we struck north and came to another broad uninhabited depression, where we discovered the Mwaru, which soon after became the Leewumbu, now flowing from the south-west under the name of Monangah, between high banks. At the ford it was about 30 yards wide and 3 feet deep, showing an enormous reduction in volume from the rapid and deep Leewumbu. This can only be accounted for by a six-weeks' dry season, distinguished by the hottest sun of the year, during that short interval of great heat which separates the little or planting rains from the great rains of the Masika. Judging from the traces of water on the banks, I should say the Monangah was a powerful river during the Masika.

From this ford we have to cross the plain of the Monangah and rise to the pastoral plateau of Usukuma, which continues in one rolling green plain until we near the Victoria Nyanza. A march of about 115 miles from the ford of the Monangah brings us to the Victoria Nyanza, which was discovered by Captain John Hanning Speke in 1858.

Before beginning a short description of the countries bordering the lake, permit me to make some remarks relative to the altitude of this lake, in reconciliation of apparently contradictory statements.

On the first journey Captain Speke ascertained the height of the Victoria Nyanza to be 3740 feet.

On the second journey, which he made with Colonel Grant, he made out the height of Ripon Falls to be 3308 feet; but it must be remembered that the instruments with which he measured the altitude he transferred to Sir Samuel Baker, then on his way to the Albert Nyanza.

On October 20th, 1875, I boiled three thermometers, and ascertained Ripon Falls to be 3369; but when these thermometers were tested and verified at Kew, the verifications increase the altitude of Ripon Falls to 4093, making a difference of 724 feet. Captain George, from my data furnished to the 'Daily Telegraph' from Africa, calculated the height of Victoria Nyanza to be 3800 feet, but he had not then received the Kew corrections. Now, turning to Sir Samuel Baker's 'Albert Nyanza,' in the Appendix we find he gives the height of the Victoria Nile below Ripon Falls at

Karuma thus : as calculated by him, 3766 feet : according to Dunkin, 3794 feet ; with Kew corrections, 4054 ; which allows only 39 feet for the Ripon Falls and many miles of rapids. The altitudes of all would read thus :—

Speke, 1858, 3740.

Speke, 1862, 3308.

Stanley, according to Captain George, thermometer not yet verified, 3800.

Stanley, according to his own calculations, 3369 ; result after Kew corrections, 4093.

Baker, on the Victoria Nile below Ripon Falls, thermometer unverified, 3766 and 3794 ; result, with Kew corrections, 4054.

The thermometer readings, therefore, agree tolerably well. Baker's, below Ripon Falls, is 205·4 ; mine, above Ripon Falls, at lake level, is 205·9.

I boiled the thermometer on Lake Victoria 27 times. The mean of nine careful calculations, with Kew corrections, gives the lake an altitude of 4168 feet above the sea. In the Appendix of my book I give the results after Regnault's, Thuillier's, and Boileau's methods, each of which but slightly differs from the other.

That part of the Victoria Nyanza which Speke sighted in 1858, and north of which he placed the islands of Kerewé, Majita, and others, turns out to be a broad spacious arm of the Victoria, which, to honour the discoverer, I have named Speke Gulf. It is about 1000 square miles in extent ; bounded on the south by Usukuma, on the south-east by the small country of Manassa and Mazanza, on the east by Wirigedi, on the north by Shashi, Iramba, and Ukerewé. The principal streams entering into it are the Shimeeyu, which we knew as the Mwaru, then the Leewumbu, then the Mouangah, and the Ruana, which pours into it from the eastern side from the plains of Tutwa and Wirigedi. There is a certain sameness in the contour on the hill ranges which confine the gulf, except that from Jordan's Nullah to Muanza the range rises almost immediately from the lake to the height of 300 or 400 feet above it. From Muanza to Magu, near the Shimeeyu River, there is a terrace which slopes gradually to the lake shores occupied by many settlements, with cultivated fields and pasture grounds for many herds of cattle and flocks of goats.

Speke was right in calling Ukerewé an island, for it is literally surrounded by water, though on the eastern side three-fourths of the state of Ukerewé is separated only by a ditch, 6 feet wide and 3 feet deep, from the mainland. One charge of dynamite at the Ripon Falls would make it a promontory ; and if the natives allowed

the grasses and pistia to grow, the ditch-like channel would soon be rendered impassable for canoes. This ditch is called the Ruggedzi, and by means of it the Wakerewé from Msossi, the capital, on the north side are able to make a short cut to Speke Gulf, without being compelled to go all round the north-west end of Ukerewé. There are several of these channels on the shores of Victoria. The Wakerewé say that the table-mountain of Majita is isolated from the mainland by a similar natural channel. The Wasoga say that Chaga, which I have marked as a promontory, is separated also in the same manner. In Uganda there are two channels of this kind, one near Murchison Bay, the other near the Katonga. The day will come also when Ukara Ugingo, Usuguru, Uvuma, and Sesse, which are now islands separated by broad deep channels from the mainland, will be divided only by these thin threads of water, such as the Ruggedzi. This natural channel being only a mile in length, we are soon enabled to pass from Speke Gulf in view of the main lake, and of the islands of Kweru, Shizu, and Ukara. On our right rises to a bold altitude the table-mountain of Majita, and, coasting by it, we observe that the coast trends north-easterly, with many deep and fine bays. At a distance of about three miles from shore the traveller is struck by the sudden subsidence of the land east of Majita. One half fancies that by standing up in the boat he could look across into Speke Gulf; but, on approaching the shore, we find that it is a low grassy plain, from 20 to 30 feet only above the lake. It would be an interesting task to calculate how many years had elapsed since the lake had subsided these few feet, and by its subsidence exposed this great extent of low land. In past days Majita was certainly an island separated by a channel many miles broad, from the hilly ridges of Usambara, which is the next prominent land to the eastward. Along the coast are numerous granite rock islands, bleached white by rain and weather, where one may study to his heart's content many a useful geological lesson. They are nearly all uninhabited at the present time, but the bananas growing upon them prove that there have been troublous times when the coast peoples have been glad to occupy them as refuges. Ururi, a pastoral country, similar in feature to Uzinja and Usukuma, extends as far north as the Gori River, in 1 s. latitude. North of it stands out the bold mountainous country of Ugeyeya, and west of a mountainous headland lies the dark and wooded island of Ugingo. Emerging from the channel between Ugingo and Goshi Cape, the lake shores again recede eastward, and before us rise two islands to the north, which I have called Bridge and Cave Islands. After wandering round many bays and creeks, at the Equator we

sight another large and lofty island called Usuguru, and through a channel, flanked by picturesque shores, enter the extreme north-eastern corner of Lake Victoria, in the bay of Manyara. From this bay we begin to skirt the northern coasts of the lake along Usoga, which is a most populous country, inhabited by a bold and warlike people. The shore rises into a picturesque line of hills, covered with fine forests. In the clearings, and at headlands and bays, one may see the glorious banana plantations, which are the pride of the African tropics. Many large and populous islands stud the lake close to the coast, the largest of which are Namungi, Usuma, and Uvuma. The dangerous character of the people of Usuma, Usoga, and Uvuma may be understood when I state that they mustered 350 canoes and a force of over 10,000 men to fight Mtesa, who had assembled a force of nearly a quarter of a million of people for the invasion of Usoga, and the conquest of Uvuma; that they defied the emperor for nearly three months, despite his overwhelming force; that they advanced to the attack on the emperor's fleet of canoes, despite his battery of four cannons and 600 muskets, with a bravery which caused me to feel most grateful that they did not exhibit their courage to such a degree as to prevent me from continuing my voyage of circumnavigation. Rounding the western end of Uvuma we enter the Napoleon Channel, and after sailing up about 20 miles arrive at the outfall of the Victoria Nyanza, called by Captain Speke the Ripon Falls, but by the natives Namweni. The river is named Ki-ira, the lake, Nyanza. The east, or the Usoga side, is called Jinja, or the Stones; the west is called Ugungu.

While standing on the Usoga side of the falls, photographing and taking a ground plan of them, I thought what an immense difference might be effected in the level of the Victoria Lake if Mtesa were assisted by engineers. He might by a couple of charges of dynamite, and the destruction of the two islands between which the surplus water rushes into the Victoria Nile, reduce the lake by 12 feet; or he might, by the employment of the vast labour at his disposal, dam up the gaps which nature has created, and soon extend the lake thousands of square miles! A dam 50 feet high would transform most of the Luwamberri plain into a broad lake; the Katonga valley and Jordan's Nullah into spacious gulfs; Ukerewé, Majita, Shashi, into islands; and on all sides would rise islets which are now crests of low hills.

The breadth of the Ripon Falls, from bank to bank, is about 400 yards. Along this breadth there are four separate falls, with a drop of 12 feet, of the respective width of 90, 15, 60, and 24 yards,

separated from each other by bush-covered islands rising about 30 feet above the falls. On the Uganda side of Jinja are steep banks covered with bush and grass, with an elevation of about 150 feet; on the Usoga side are steep banks about 200 feet high, sloping gradually upward to a level terrace 300 feet above the lake.

The view down the Victoria Nile is beautiful; the steep banks are edged with succulent grass, and clothed with trees and a dense darkening bush. The land on either side uplifts into hill-masses, their crests wooded with acacia, evergreen bush, euphorbias, and here and there statelier trees cropping out above the general level into view.

Looking down the broad stream, the eye has a reach of seven or eight miles, along which the Victoria Nile, with pale-green waves and crests of foam, rushes over the rocky obstructions with resistless vigour. Hippopotami and crocodiles haunt the quiet bends, and the latter may be seen basking in the sun on every strip of sand or dry rock. On an overhanging bush, under the shadow of a rocky mass, sits the corpulent diver, and perched on a solitary tree is a white-collared fish eagle, calmly contemplating the bright flashes of water and furious career of the stream. One could scarcely wish to behold a more beautiful or a more inspiring scene than that which the full-born Nile has created.

Consider now the mass of water which, since an immeasurable period, has been discharged against the rock mixture of granite and ironstone, cemented together by such a compound as tufa and a friable conglomerate, of which that barrier to the primeval lake was formed. Given a breadth of 400 yards, a depth of 10 feet, and a current of three knots, we have 60,000 cubic feet of water falling out of the lake every second, which in twenty-four hours would be 20,908,800 tons, and in a year of 365 days, over 7631 millions of tons, or about 5 tons of the sweetest drinking water per annum for every inhabitant of this globe.

The Damietta mouth of the Nile is in north latitude $30^{\circ} 31'$, the remotest sources of the Shimeeyu, the Nile's furthest southern tributary, is in south latitude $5^{\circ} 30'$, which gives the great river a course over 2221 miles of latitude, which by its windings is made to extend to 4200 miles in length. Yet, though flowing over 1500 miles of thirsty desert without a single influent, it discharges into the Mediterranean, on an average throughout the year, 101,000 cubic feet of water per second. But to supply this steady outpouring of water the Nile requires the Lakes Muta Nzige and Albert: the Rivers Unyame, Asua, Kweeni, Bahr-el-Arab, the

Sobat, the Blue River, and the Atbara, the whole of which it drains, from a water-supplying area of 900,000 square miles, though the Nile basin measures 1,425,000 square miles.

The northern coast of Uganda, as we proceed west, is penetrated by several deep bays almost as large as the Napoleon Channel, among which I may name Grant and Murchison and Chiwunuko bays. Like the hills of Usoga, those of Uganda form a picturesque range of the same height as those which bound the lake on the south-west, south and south-east; but the northern coast, as is evident by its verdure, its forests of magnificent timber, is more favoured, receiving the moisture drawn from the evaporation of the lake, and borne against the northern shores by the south-western and south-eastern winds at a period when the evaporation is greatest. The supplies of timber available in Uganda may be imagined from the fact that the emperor has nearly 500 canoes of all sizes, and that few trees furnish more than two planks, and that it requires on an average three trees for the planks of each canoe.

At the north-west end of the lake issues the Katonga, which rises from a north-north-west direction. It is quite a broad river, but the current is very sluggish. Thence we commence to skirt the western shore of the lake, first along the coast of Uddu, and enter the channel between the large island of Sesse and the mainland. Sesse is inhabited by the most skilful canoe-builders in the world, and I must confess that, considering their primitive tools, they have succeeded in perfecting the art of canoe-building. I doubt if anything more graceful or more artistic than one of their war-canoes could be conceived. But, alas! the character of these superb boat-builders for bravery is very low indeed, otherwise they might have become the British of the lake, and from their island dictated terms even to Mtesa.

After passing Dumo the western coast of the lake becomes characterised by lofty spurs or projections from the pastoral plateau of Koki, and soon we arrive at the bay which receives the greatest affluent of the lake, viz., the Alexandra Nile, which, according to calculation, supplies fully a sixth of all the water received into the Victoria Nyanza. It is the Amazon, in fact, of the lake rivers. Even the natives, though none of them had ever circumnavigated the Nyanza, entertained, through some means, a dim conception of the truth, for they styled it the "Mother of the River at Jinja," which of course is the Victoria Nile. They have an idea, indeed, that the lake would dry up were it not for this powerful river. It rises at the southern base of the Ufumbiro cones, and flowing with

a wide curve through Ruanda under the name of the Ni-Nawarango River, enters the Alexandra Nyanza, which receives also the Kagera, or the Alexandra Nile. This last stream rises south between Uhha and Urundi.

A few miles south of this bay the coast is formed by the wall of the plateau of Uzungora, the whole of which as far as Uzinja to the south-west is inhabited by a peculiar tribe, strangely Abyssinian in feature. Between Uzinja and Uzungora issues the Lohugati, under the name of Ruwambu, and on the southern side of the river the land subsides into those lower hill ranges which we observed bounded the lake south. By following the coast of Uzinja we arrive at that prolongation of the lake which separates Uzinja from Usukuma, and have thus circumnavigated the Victoria, for we are soon in sight of Muanza, whence Speke obtained his first view of the lake which occupied me the better part of six months to explore.

The basin of the Victoria Nyanza, which of course includes all that area that supplies water to the lake, covers 90,000 square miles, of which 21,500 square miles is occupied by the Nyanza itself, 800 square miles by the Alexandra Nyanza, and 720 square miles by that singular formation now occupied by the chain of lakelets between Ruanda and Karagwé.

I will touch upon Lake Victoria again before leaving the lake lands of Equatorial Africa, but I cannot refrain here from recording my admiration of Captain Speke, my predecessor in this region. Twice I have been compelled to attempt the art of outlining on paper bodies of water upon mere report, and I must confess that I have done it with considerable fear and trembling, for I felt that I might just as well attempt to catch the forms of drifting and ever-changing clouds; but with Captain Speke there was no hesitation. His hand is unerringly firm. His strokes are like those of a master artist, sharply defined, bold, and unwavering. Whether it is the enormous grey Nyanza to which he attached the name of Her Majesty the Queen, or that other, distinguished by the name of Albert, there is but little left for the actual circumnavigators to change.

Upon leaving Lake Victoria, the next important piece of exploration which we undertook was marching westward, in the hope of being able to circumnavigate Lake Albert. While proceeding in that direction, I felt assured that I was bound for the lake discovered by Sir Samuel Baker.

From our camp between the debouchure of the Alexandra Nile and the Katonga, we proceeded to the northern bank of the latter,

to recruit our force with a large body of auxiliaries lent me by the Emperor of Uganda. Thence we marched along the right bank of the Katonga, until entering Unyoro our course was south of west. An observation by double altitude proved that on the 7th of January I was in lat. $0^{\circ} 5' 0''$ north, whence I obtained a glimpse of an enormous mass rising in the country of Gambaragara, which I have called Mount Gordon Bennett. We were then encamped at an altitude of about 5500 feet above the sea, and, considering the great distance, though perhaps exaggerated by the foggy state of the atmosphere, I estimate this mount to be at the height of 15,000 feet above the level of the ocean. It was only a day or two before that I had obtained a view from a height of 6000 feet of a similar formation—though not so elevated—to the south, which I have named Mount Lawson, in the district of Kibanga in Ankori. We then cross the Katonga, and our course is west-south-west, and in a short time we cross the water-parting between the Katonga tributaries and those which run westward. We soon find that these west-flowing tributaries flow into the Mpanga, which flows from the north, most probably from near the base of Mount Gordon Bennett, and, following its left bank, we arrive at the confluence of the Rusango and Mpanga. The Rusango flows from the south-east, that is, from the western base of Mount Lawson, and is an ice-cold stream of considerable volume. After fording this river, a strenuous and long march brought us to Uzimba, near the lake, which was our objective point. A couple of days afterwards we moved west, until we were only a mile from the verge of the cliffs which rise from the Beatrice Gulf. The position we then occupied was $30^{\circ} 17'$ east long. and $0^{\circ} 7' 0''$ south lat. We despatched 500 men down the cliffs to a locality called a Salt Bunder, or a salt market, on the eastern shore of the lake, which the natives and the Waganda called Muta Nzigé.

After M. Gessi's circumnavigation of the Albert Nyanza, there existed some hope that a short narrow channel might connect it with Beatrice Gulf; but Colonel Mason, of Gordon Pasha's staff, with his latest report perplexes me considerably.

General Stone, chief of the Egyptian staff, has kindly furnished me with a copy of Colonel Mason's map, which only shows a length of 97 miles, a breadth of 22 miles, and a comparatively insignificant area of 2134 square miles! The southern extremity of this lake is therefore over 80 miles north of our camp at Unyampaka. But near the south-east corner of the lake Colonel Mason discovered a large river about 400 yards broad, with a northerly current, and high banks clothed with forests, which he ascended for an hour,

but as he constantly got aground he was obliged to return. A mass of vegetation blocked the way to the south and up the stream.

After a careful examination of M. Gessi's and Colonel Mason's maps, I cannot find a single name coincide with any of the native titles of countries and chiefs obtained by me. Nothing of the great country of Usongora, of the island state of Utumbi, of Gambaragara, Turu, Irangara, Buhuju, Unyampaka, Ankori or Usagara, Kibanga, Uzimba, Kabuga, Ruanda, Mpororo; nothing of the rivers Rusango or Mpanga. Though the lake is "97" or "150" miles in length, neither Colonel Mason nor M. Gessi has given more than half-a-dozen native names—and of these not one is familiar to me.

Had Colonel Mason and his predecessor, Signor Gessi, not been so positive, I should have felt certain that I had discovered an arm of Lake Albert. But Colonel Mason declares that the south-east angle of Lake Albert is in $1^{\circ} 11' 03''$ north, and this position is only four miles south of Vacovia, above which place, at an altitude of 1400 feet, Sir Samuel Baker gives in very precise terms a different version altogether from Colonel Mason. He writes on the 14th of March, 1864, as follows:—"The day broke beautifully clear, I hurried to the summit. There, like a sea of quicksilver, lay far beneath the grand expanse of water—a boundless sea horizon on the south and south-west." If the day is beautifully clear, and an observer stands on an elevation 1400 feet, he ought to be able to define land at a distance of 50 miles at least, even under the Equator of Africa. In proof of which is Burton and Speke's view of the Goma Mountains from the hilly ridge east of Ujiji, and Commander Cameron's and my own experiences on two expeditions. From the Ujiji beach on clear days I have often seen Cape Kabogo, which is 41 English miles distant. On Lake Victoria, by climbing to a height of 200 feet above the lake, I tried to obtain a view of Ukerewé's north-west end, which was 61 English miles; but even with a powerful field-glass I could see nothing, while Iroba Island, 31 English miles south, was plainly visible. We hear a great deal about mirage on the lakes, but it did not prevent Speke, when standing near Muanza, 250 feet above the lake, from seeing Majita Mountain 40 miles off. Nor did it prevent Speke and Grant from viewing Ufumbiro Mountains at 45 miles off; and Baker himself says that at 50 or 60 miles' distance blue mountains rose to the west of the position on which he observed the lake to a height of about 7000 feet above the level of the Albert. Mirage exaggerates and distorts rather than diminishes. For instance, while floating down the Livingstone a crocodile on a sand bank became a canoe, and a dead tree became a ship whose

masts were merely the upright roots of the prostrate trunk. If Colonel Mason's position of the south-east end of the Albert had been $1^{\circ} 11'$ s. instead of n., everything would tally, and Sir Samuel Baker would have been verified, but it is a hopeless task to attempt to reconcile two statements so diametrically opposed to each other; for Sir Samuel's observations at other points have been verified, and Colonel Mason is considered to be an accomplished gentleman by Gordon Pasha and General Stone, his chiefs.

After rising again from the wild mountain land near Beatrice Gulf to that divisional ridge separating its tributaries on the east, we descend to the valley of the Katonga. Thence we march south over the pastoral plateau of Bwera, and skirting the walls of Koki plateau, enter the valley of the Alexandra Nile. Crossing this river we ascend after a few miles one of the longitudinal mountain ridges of Karagwé, the land *par excellence* of cattle and rhinoceroses.

As we travel south from some of the higher elevations, we see to the west Ruanda similarly characterised by longitudinal ridges and lateral valleys, and between Ruanda and Karagwé a chain of 17 lakelets, occupying a lengthy and wide basin, which in old days must have been a lake extending from Uhha to the Victoria Nyanza, and is to-day a rush-covered basin of oval form, more than three-fourths of which is covered by water.

At Western Usui and Northern Uhha the longitudinal ridges which characterise the land formations of Karagwé and Eastern Ruanda appear to be gathered into clumps, and to abut against the transverse ridges projected westward from Southern Ihangiro, consequently we arrive at the water-parting which divides the Nile waters from those of the Tanganika. The crest of this watershed is 6000 feet above the sea. An idea of the close relationship between the Nile and the Tanganika waters may be gathered from the fact that after travelling up a ravine two hours, at the head of which the Lohugati rose, we ascended a steep grassy ridge, and about 2 miles south, from a cleft in the southern side, found dripping over ferns and mosses the first drops of the extreme northern affluent of the Malagarazi, the largest river that flows into Lake Tanganika.

From this lofty river factory our course was now south, and we gradually descend by means of sloping spurs down into the forested valley of the Malagarazi, called Northern Unyamwezi. When we had fairly reached what may be called the forested plains, we had the Malagarazi to the west, flowing between the eastern slope of pastoral Uhha, and beyond that the mountains of Western Uhha—at the western base of which flows the Alexandra Nile, between

Uhha and Urundi. West of mountainous Urundi is the Tanganika. East of us we have the uplands of Unyamwezi, and the broken hilly country of Uzinja, which extends from southern Ihangiro to the softly rolling pastoral land of Usukuma.

After travelling some two degrees of latitude south, our route diverged west through Uzinza and Ukaranga into Ujiji, the Arab port on the east coast of Lake Tanganika. Here we prepared for the circumnavigation of the great lake discovered by Burton and Speke.

The northern part of the lake extending from Ujiji along the east coast up to the northern end, and down the western coast to a point opposite Ubwari, had been explored by Livingstone and myself in 1871, in the hope of finding an outlet, believed at that period by Livingstone and others to connect the Albert Nyanza with the Tanganika in that direction. It is unnecessary to repeat here that the exploration then made was so minute as to leave no doubt in our minds, and to satisfy us that there was no outlet in the neighbourhood of the north end. It now only remained for me to explore the southern half of Lake Tanganika, and the western side of the lake from Kasengé to that point whence Livingstone and I had abandoned the task of 1871.

But in a note which Captain Prideaux sent me from Zanzibar, and which I received at Bagamoyo, I was informed that Lieutenant Cameron had already discovered the outlet of the Tanganika to be the Lukuga, and in a newspaper given me by Colonel Linant de Bellefonds was an account of it, which appeared to me so extraordinary that I resolved to investigate it myself. This surprise was partly owing to my experience of the streams and waters that I had seen in 1871, received by the Tanganika, such as the Malagarazi, the Liuché, the Mshala, the Rusizi, and the Mtambara, and 22 other rivers, which, united, I estimated to pour out 25,000 cubic feet of water per second. If the northern third of Lake Tanganika, thought I, receives 25,000 cubic feet of water every second, what must the other two-thirds? Surely at least 40,000 cubic feet of water. How can this 65,000 cubic feet of water per second be accounted for by this current of 1·2 knot per hour, and a river bed impassably choked with papyrus or reeds? Then here are the natives all united in declaring that this Lukuga does not go out of the lake, and here are two of the palm-trees that in 1871 were in the market-place of Ujiji, now 200 feet in the lake, while the beach on which Livingstone and I promenaded, is inundated; rice fields of thirty years ago are to-day covered by three or four miles of water, and there has been an average increase of 1 foot per annum

since that period. Such were some of the reflections which inspired me to make a complete circumnavigation of the lake. It is needless to describe the coasts minutely. From Ujiji we proceeded south along the eastern shore, coasting by the countries of Ukaranga-Tongwé or Kawendi, Fipa, and Urungu, to S. lat. $8^{\circ} 47'$. Thence, after tracing the southern end, turning north along the western shore, first of Urungu, then of Uemba, Marungu, as far as the Lukuga Creek, which is one of the inlets penetrating the shore of Uguha. Entering this inlet, we came at three miles to a barrier of black seething mud, covered by a thick growth of papyrus, dense as a field of Indian corn. An experiment to ascertain the current, which I made, revealed that during the south-east monsoon blowing *into* the creek, there was a current towards this barrier which bore a disc of wood at the rate of 822 feet in one hour, minus 22 seconds; but in the afternoon the same disc returned towards the lake, a distance of 159 feet, in 19 minutes 30 seconds. A land journey along this barrier enabled me to see that for three miles the depression between the two banks of the creek was absolutely choked with the papyrus, except where there were shallow pools of perfectly stagnant water, breeding tadpoles and animalculæ, slimy, oozy, torpid quagmires, or uncovered black mud deposits, over which frogs luxuriated. Three miles west of this scene, at the road which crossed this depression, the papyrus had given place to a denser, taller growth of matete, or water-cane, and the natives had crushed a narrow path, and formed a tunnel-kind of passage-way from one bank to the other. In the middle, occupying perhaps 50 yards of the breadth, we discovered an unmistakable current gently flowing westward, and the water was 7° cooler than the Lukuga Creek. A few more miles of this dribbling through the reeds, and the Lukuga, which flows through Rua into Webb's Lualaba, assumes the aspect of a clear river. Native report, which corroborates my own personal observation, proves that at the time of Cameron's passage the natives crossed the Lukuga on dry land; and I find in the 'Journal' of this Society, page 221, vol. xlv., the following singular statements of Lieutenant Cameron, which should be taken into consideration. They are singular from the fact that, though I was unaware of it, Lieutenant Cameron heard the same statements that I heard, and that his diary, published in your 'Journal,' vol. xlv., is the best proof that we have both rigidly adhered to what we have heard and seen, and only differ in conclusions and inferences.

Cameron says: "I can't make out the guides; they said there was a big river going out of the lake, called the Lukuga, but now

they all come up and say (directly the natives say it comes in) that they had seen it with their own eyes. I hear from the natives that the river (the Lukuga) comes into the lake." On page 222, entry next day, he continues:—"Chief's name Luluki; now he and his people assert that the river (the Lukuga) goes out of the lake; lots of grass in it; I feel jollier now, hearing that the river does go out. From the look of the lake, this seems to be the place for it. I am all impatience to see the river; I tried hard to be good yesterday when I heard it came in—precisely what Livingstone's and my experiences were at the Rusizi—and remembered 'Thy will be done.' I feel so on the tenterhooks of expectation about this river that I cannot quietly settle down to anything. God grant that I may not be disappointed."

On page 223, he arrives at Lukuga, and says:—"Well, first of all, when we got in, the river seemed to be a myth again as regarded its leaving the lake; there certainly was a slight current setting in, but that might be caused by the wind and sea outside." It must be remembered that he has such entries as "slashing breeze freshening up from eastward," "Wind good," "My eye is at least 7 feet above the water, and many waves passed far above the horizon," "I have no doubt these winds are from the south-east." He continues, "a native, who showed us where to camp, said that in half a day the Lukuga came to a big hill and came to an end. When I said there was no big hill, he said it only went a short way into the country, and was not a river at all, but a part of the lake." On the arrival of the chief, however, this disheartening tale is superseded by the more hopeful report: "The navigation is difficult; lots of tingly-tingy and sindy, but it goes into the Luabala; his people travel a month by it. If I had a glass of grog I'd drink it in honour of the discovery. Findlay was right in his conclusion that the Tanganika was one of the sources of the Nile, although his premises and chain of reasoning were wrong."

Now on page 224 we have the result of his personal investigation of the supposed outlet—too brief, in fact, for its importance—in these words:—"4th May.—Went 4 or 5 miles down the river, 3 or 4 fathoms deep, and 500 to 600 yards wide, but we were stopped by grass; however, for small canoes a way can be cut. There is a sort of bar across the entrance, caused by the washing away of the shore outside. 5th May.—I make across the river, at the beginning 1·5 mile, but most of this is closed by a grass-grown sand-bank, leaving only a small entrance at the southern end, when there is a bar on which the surf breaks pretty heavily at times."

On page 226 he says:—"The Lukuga certainly had a distinct

current out of the lake. When I was there I got the boat in a place out of the wind, and she swung round to the current quickly, and bits of wood which I threw overboard, and timed to test the rate, gave 1·1 and 1·5 knots. Certainly there had been heavy breezes for some time up the lake from the south, and when we were in there, the wind for part of the time was blowing up the river."

On page 227 he says:—"I quite fancy that the Lukuga may not be the real outlet, but where does it go? Where does all the water go? The rain—now falling heavily—where does it go? Above the Lukuga may prove to be only a marsh, but I believe it will turn out to be the Ruama or Luama into which the Lukuga flows."

I have not the time or the disposition just at present to enter more fully into the subject, but I may ask, in the words of Cameron, where does all the water go? What becomes of all this water drained by the tributaries of the Tanganika, from an area of 67,000 square miles, with its 60,000 cubic feet per second of water supply which is furnished by its hundred streams? If there were not something remarkable about this lake, which receives as much water as the Victoria Nyanza, why is it that there is no such outfall as that which pours unceasingly over the Jinja ledge to the Victoria Nile, or through the defiles of Mweru into Lualaba? Why is it, may I ask, do natives, and Arabs, and Cameron speak thus in doubt about the Lukuga? At one time believing that it does flow out of the lake, at another time that it flows into the lake? Why is it that there should be a bar of sand nearly closing in the outlet in Cameron's time, and in my time that same bar of sand completely covered by water, on which in stormy days a wild surf is created? Why, if an outflowing river, should there be stagnant pools and quaggy mud-deposits in its course? Yet why is it that in the hilly ridge six miles west from the entry into the Lukuga there is a water-worn gap from the crest of the ridge to the bed of the Rua Lukuga, 600 feet deep, when I could give nearly a hundred proofs that the Lake Tanganika is rising; that I could quote from Burton, Livingstone, and Cameron to support this statement? And why is it, if the lake is rising, that the southern half of the lake shows that its level was fully 150 feet higher than it is now?

General Strachey, in his address to the Geographical Section of the British Association at Bristol, said very truly that "it is the task of the geographer to bring together from all places on the earth's surface the materials from which shall be deduced the scientific conception of nature; that the task of the traveller, who is the journeyman of science, is to collect from all quarters of the earth

observations of fact, to be submitted to the research of the student, and to provide the necessary means of verifying the inductions obtained by study, or the hypotheses suggested by it." I have furnished a few hints from a mass of material upon which the student may set to work, and I would specially refer him to Cameron's frank and interesting diary of his voyage round Lake Tanganika, which is published in your 'Journal.'

It may be imagined, then, not having discovered an outlet in the Lukuga Creek, with what searching eyes I explored that part of the Tanganika coast unvisited by any one previous to myself. I mean that part extending from Kasengé to the point whence Livingstone and myself struck across Burton Gulf to Panza Point in Ubwari; but from a point of the coast west of Kasengé, the mountain-ridge which surrounds the lake rises higher in Goma than anywhere else, and its lofty and precipitous shore presents nothing but baylets and waterfalls, until in Northern Goma the range deflects to the north-west, and as we approached it from the south, no point seemed to be so promising as this. Where the range deflects north-west, a low projection of land is observed extending north, which presently rises again and forms the lofty promontory of Ubwari, 27 miles in length. West of this promontory is a deep bay, 20 miles in length and 6 or 7 miles in width, which I have named in honour of one of the discoverers of the lake, Burton Gulf. After rounding this gulf and examining the rivers Kasansagara and Mtambara, the circumnavigation of the Tanganika had been effected, and we returned to Ujiji. In crossing the lake, I spent an hour in mid-lake sounding, and with 1200 feet length of line, found no bottom.

While the grey Nyanza expands with equal breadth and length, the Tanganika is like a trough, with a length of 329 miles and only an average breadth of 28, deep sunk in the bosom of mountains, varying from 1000 feet to 3000 above its dark-blue waves.

Its principal affluents are the Malagarazi, 280 miles; the Rufufu, 150 miles; the Rusizi, 120 miles; the Rungwa, or Rikwa, 115 miles; the Rubuku, or Lufuku, 110 miles; the Liuche, 110 miles; the Rugufu, 80 miles; and the Mshala, 60 miles long. Besides these important rivers there are nearly a hundred small streams. With all the enormous supply conveyed by these rivers into the lake there is no visible outlet!—for the Lukuga, which drains the reed-covered ooze and mud-banks at the end of Lukuga Creek, could not be called, up to 1876, by that term. We may estimate the quantity of water received by the Tanganika as being fully equal to that which is discharged into the Victoria Nyanza; yet while

the natives of Karagwé and Uganda, and the Arabs, could readily direct Speke to the river outflowing from the Nyanza, no Arab, Mgwana, or native could inform either Burton, Speke, Livingstone,, or myself where to look for the river outflowing from Lake Tanganika. Cameron was fortunate, however, in discovering the Lukuga Creek at a spot where the people of the country near it informed him and myself that the same river had an inflow as well as an outflow.

After a thorough exploration of the locality, a study of all the information received, and many ocular proofs that the Tanganika is rising and gaining upon the shores year by year, I have concluded that the Lukuga must soon become an effluent of nearly as great a volume as the Victoria Nile, which issues from the Victoria Nyanza.

Among the legends which the natives of the Tanganika shores related to me, were several about mysterious islands having frequently been seen by voyagers to appear and disappear. Tired rowers are said to have encamped on these, and of them and their resting-places nothing has been heard since!

A late eruption or escape of bitumen from Ubwari, or the coast of Goma, so great as to blacken the surface of the lake for many miles, gave birth to curious ideas respecting its source. The natives declared it to be the "discharge of lightning"—but the shrewd Arabs called it pitch or tar. The fall of a hill-shoulder, which I am told had disastrous consequences, has been another source of local wonder and terror.

We started from Ujiji, on our voyage round the Tanganika, about the middle of June, and returned in the beginning of August. During all those months the south-east or Ma'anda, and the south-west or Kazi-Kazeen, blew dead against us, as we proceeded south, and as we came northward were fair and astern, the latter wind being the more violent, though we had on one occasion quite a tempest from the south-east. The north-east monsoon also varies to the north-west, and lasts from the latter part of October to the latter part of April.

During this last monsoon the rains fall for the first three months with a certain regularity, lasting for several hours almost every day, though there are intervals of even two or three days of dry weather. These dry periods are distinguished by great heat. The highly-heated air from the slopes and valleys near the lake ascends rapidly, and, meeting the cold winds of the mountains and the higher altitudes, creates air-currents of unusual force, which, descending upon the Tanganika, produce extremely violent tempests.

During the north-east monsoon, also, the waters of the lake, driven southward each day, are pressed against the southern end of the lake; but while the south-west monsoon blows, the Tanganika is said by the natives to flow north, which means that the waves are driven towards the north-east. It is at this period that the reedy Mitwansi of the Lukuga feels the greatest pressure by the mass of water forced up the creek, but the instant the wind relaxes, a noticeable set has been observed by me towards the lake.

Our next journey of exploration was to the north-west of Lukuga Creek, over ground previously traversed by Livingstone and Cameron, as far as the Luama ferry, but here our routes diverged, and I preferred, having followed the Luama from its source, to cling to it to its junction with the Lualaba. The Luama has a course of 250 miles, and joins the great river in south latitude $4^{\circ} 47'$. Like the mighty river itself, though shorter in its course, it receives no less than 84 streams, which our route crossed from its source to its mouth. If we place 160 streams as the number it receives from both banks, we should probably be within the mark. This vast number indicates the excessive humidity which characterises the western versant of Lake Tanganika western mountain barrier. This river alone furnishes over 40,000 cubic feet of water per second.

From the confluence of the Luama and the Livingstone we travel through the rocky plains of Uzura, and after two days' march enter Manyema. Nyangwé is 32 geographical miles from the confluence, or in south latitude $4^{\circ} 15'$.

I must here attempt another reconciliation between apparently contradictory statements. Livingstone gave the height of Nyangwé above ocean-level as being 2000 feet. Cameron ascertained it to be 1458 feet, I believe, and I reckoned it to be 1480 feet; but the Kew corrections raise these, according to Regnault's tables, to 2077; according to Thuillier's, to 2033; and after Boileau's method, to 2023 feet. I feel confident that if Cameron's thermometer be tested at Kew, and everything be recalculated from the same data, that we shall find Livingstone was right.

The mean of Tanganika readings for altitude makes this lake to be 2756 feet. Cameron makes it out to be 2710 feet. Now the distance between where I believe the Rua-Lukuga joins the Lualaba, and the entrance of the Lukuga Creek from the Tanganika, is 160 geographical miles; this distance gives a sufficient fall of over four feet to the geographical mile from the altitude of the Tanganika to that of the Lualaba. Commander Cameron believes

that the Lukuga River follows nearly a dead level, and meets the Luvwa south of the latitude of Lukuga; it may be so, but in my opinion it is totally opposed to the curious curve which is a peculiarity of the Livingstone, and every other tributary of the great river. Indeed I found it a safe guide, in forming a private hypothesis respecting the course of the Livingstone, to regard the peculiar curve of the Luama, and the Kwango of the Portuguese, though no one had traced its course. Yet we knew that the mouth of the Congo was somewhere about $6^{\circ} 8'$ south, coming from E.N.E., or nearly, while Livingstone found the Kwango in south latitude 11° . When the Arabs told me that the Lualaba flowed north, I had an idea that the great river might possibly reach even as far as 2° north, in order to advance sufficiently northward to give it that E.N.E. direction that the Congo expedition of 1806 gave it. Any hypothetic course that we may desire for a tributary for the Lualaba-Livingstone must be safe enough if we follow the peculiar curve of the main river. It is for this reason that I feel the more convinced, having tested the accuracy of this hypothesis, that the Wellé of Schweinfurth is the large river called the Aruwimi.

The great river, which, at the season I visited it, rolled a volume northward of over 230,000 cubic feet per second, was discovered by Dr. Livingstone to be the Chambezi, rising in the Mambwé hills, in about east longitude 32° , south latitude 10° . Flowing south-west, it enters Lake Bemba, or Bangweolo, and at the north-west corner of this lake flows northward between east longitude 28° and 29° , and in about south latitude $9^{\circ} 30'$ enters Lake Mweru under the name of Luapula. In about south latitude $8^{\circ} 30'$ it issues from Mweru under the name of Webb's Lualaba, and flowing diagonally, or north-west, it reaches Nyangwé in south latitude $4^{\circ} 15'$, east longitude $26^{\circ} 16'$. In its course between Mweru Lake and Nyangwé it receives several fine affluents—the Kamalondo on the left bank, the Luibi, the Luihi, the Luama, the Lulindi, and the Kunda from the right bank.

Now that we understand the course of the main river, it is not difficult to understand the character of its basin. Having traced the eastern face of the western mountain chain of the Tanganika, we can quite believe, from what we have seen of the Luama with its 160 streams, that an enormous number of streams must be discharged down the western versant of that mountain chain between Mambwé and the Luama. As we proceed northwards towards the Equator and see those magnificent influents issuing in succession—first the Kapembwé, then the Luà, then the Urindi, then the Lowwa, then the Léopold—we can quite appreciate the humid character of

that region east of the Livingstone and north of the Luama, for within a course of 287 geographical miles we find the great river supplied by eight powerful streams from the eastern bank, while from the western bank we find only four, which are the Ruiki, the Kasuku, the Lumami and the Black. Some weeks ago I had the honour at St. James's Hall of informing you about the terrible forests of Uregga, which, from all I could hear, covered a vast area of that region. In our exploration of the north end of Lake Tanganika, I said the mountains on the west side extend towards the north. Imagine this mountain chain prolonged in a north-west direction until they are joined by that chain of mountains observed by Sir Samuel Baker on the west side of the Albert, which divides the waters flowing into the valley of the Livingstone, and those which are found down their steep eastern slopes to the Albert. Understand also that the Livingstone River does not begin to flow north-westerly until it is north of the Equator. This north-west course it maintains to north latitude $1^{\circ} 52'$, at a point which is about 500 geographical miles from a point on the western shore of Lake Albert. This north-west course is 220 geographical miles in length, during which time its volume has been increased by the important river Mburra, and the still more important Aruwimi, which I conjecture to be the Wellé. If this river is the Wellé, even with the curve peculiar to the Livingstone, it has a course of 500 geographical miles, sufficiently long to enable it to increase its volume from the 10,000 cubic feet per second, ascertained by Schweinfurth near Munza's, to the 130,000 of the Aruwimi. Schweinfurth feels convinced that it belongs to the Shari; yet the supposition is that the Shari empties into Lake Chad only 85,000 cubic feet per second. Now, the Shari—if the learned German traveller is correct—being an Equatorial river, after flowing over 810 geographical miles in a direct line from Munza's, has only 85,000 cubic feet. Now can we account for the Lualaba at Nyangwé with a volume of 230,000 cubic feet in a second after a course of 780 miles, that is, from Mambwé Hills to Nyangwé? Indeed my conviction that the river of Schweinfurth is the Aruwimi becomes stronger each time I discuss the question with myself. At that time, when passing the confluence, I had not the slightest doubt, and the opinion has been strengthened by comparing the customs of the Monbuttu with those of Koruru. The Livingstone from this point, north latitude $1^{\circ} 52'$, flows west across two degrees of longitude, then begins to deflect gradually towards the south, in east longitude 19° , north latitude 1° . Thence its course is about south-south-west over 5 degrees of latitude, receiving now its greatest influents from the left bank, namely,

those streams whose head-waters were crossed by the Pombeiros, Livingstone, Magyar, and Cameron. The largest of these is the Ikelemba, which is the Ohio of the Livingstone. One hundred and thirty miles the Ikelemba and the Livingstone flow side by side in one bed, without commingling their waters, for while the great river is of a grey-brown colour, the Ikelemba waters resemble tea. South of south latitude 3° , the enormous volume of the Livingstone is still further increased by the fine river Ibari Nkutu, which is no other than the Kwango of the Portuguese. From the right bank it has received the Lawson, the Mpaka, the Kunya, and the Bangala Rivers. Soon after receiving the Ibari Nkutu, the great river, which has been gradually contracting, suddenly expands, and forms a pool of 30 square miles. The boiling-point, with Kew corrections, makes it to be 1147 feet above the level of the sea. At the western end begins the first cataract of the Livingstone Falls, after an uninterrupted flow of 898 English miles, with a declination of 5 inches to the mile. The river at Ntamo has reached the verge, as you may say, of a gently sloping table-land; for from this point for a distance of 155 geographical miles it is a succession of cataracts and rapids to the lowest Fall of Yellala. Captain Burton discovered the altitude of the Congo at Boma to be 73 feet above the ocean; there is then a fall of 974 feet, or a little over 6 feet to the mile, between Ntamo and Boma.

If we include the basin of the Tanganika, which did and must again supply water to the Livingstone, this mighty river obtains its supplies from an area of 952,000 square miles, and, like the Amazon, from an equatorial region, which accounts for its sudden and quick increase of volume. Unlike the Nile, from its very source to its exit into the Atlantic Ocean, almost every square mile sends some small portion of water to swell its power and force. It has no thirsty desert to feed, it has no extent of level land to irrigate, but from both banks the affluents flow, bringing with them to its deep and capacious bed the burden of moisture which they have drained from the humid tropics. There are many rivers of longer course, such as the Amazon, the Mississippi, the Nile, the Yenisei, the Yang tse Kiang, but there is only one river which rolls a vaster flood to the ocean, and that is the giant Amazon.

The water area of the Livingstone is larger than any river in the world, unless you include the St. Lawrence. It covers 35,000 square miles. The great basin, which lies between the western Maritime region and the Central Lake region, and through which the Livingstone has channelled a broad bed of from one to eight miles in width, appears to me to have formed the bed of a vast

lake, extending from the Livingstone and Zambezi watershed south to the Nile-Shari and Benué, and Livingstone watershed north, with a breadth of 700 geographical miles, forming a vast inland sea of 630,000 square miles, nearly four times larger than the present area covered by the Caspian. The bed of this ancient lake has been but little disturbed. The lacustrine deposit is still there; the forms given to its shores by the waves are still visible; the progress the river has made through the green, horizontally stratified shales and green-stone of the Upper Livingstone may be measured in feet. The cause which refused great depth instead of great width to its channel lies in the undisturbed horizontally stratified gneissic bed, the effect of its currents may be viewed in the softly rounded and low grassy hummocks which dot the interior plains on either side. It is needless to look for the Lunæ Montes in that northern water-parting, for we shall find none. There may be isolated hills, or even a chain of low hills, but only like that low water-parting which separates the extensive plateau in which the Red River, the St. Lawrence and the Mississippi are born; or like the plain of Eastern Europe, which is drained northwards by rivers discharged into the Baltic, the Volga into the Caspian, the Don, Dneister and Danube into the Black Sea; or, to quote an African example, like that low water-parting which separates the sources of the Shimeeyu, or of the Nile from the Eastern tributaries of the Malagarazi, such we may hope to find.

I could give a hundred proofs that the Bemba, the Mweru, the lakelets of the Kamalondo, are but the residue of that vast lake which occupied the basin of the Livingstone during that period called by geologists the Mesozoic, or the secondary age. The volcanic orifice, the downward flow of the lava, the sudden subsidence, the creation of an irregular fracture, the lines of rocky fragments, the ruinous heaps of the ancient granite copings, are really such clear proofs, that I have no hesitation in pointing out to you the deep chasm of the Livingstone as that which drained the great ancient lake. But to prove it satisfactorily to you, or to describe satisfactorily any of the great geographical features of the continent that I have touched upon to-night, would require several carefully prepared papers relating to the "Table-land of Eastern Africa," "The basin of the Victoria Nyanza," "The Lake Regions," "The Lukuga Creek," and "The Livingstone Basin," after which I should hope to have embraced the principal points of interest tending to explain the Physical Geography of Equatorial Africa, by which the scientific student at home might begin to elaborate the crude facts gathered by the explorer.

I will close this hastily written Paper by taking this opportunity of thanking the President and Council of the Royal Geographical Society for the very high and signal honours which they have bestowed on me for the few years I have sacrificed towards the solution of some of the secrets of African Geography. Words of gratitude are soon uttered, but the feelings which prompt them will endure while I live.

The PRESIDENT said if any justification were needed by the Council for the earnest and persistent effort they had made to induce Mr. Stanley, notwithstanding the continuous labour he was engaged in, in producing a book, to prepare a geographical Paper to be read at their Meeting, it would have been afforded by the address to which they had just listened. Mr. Stanley had been marvellous as an explorer, but he had now shown that he was still more remarkable as a geographer. They would have to search far in the history of geographical discovery before they would find a man equally successful as an active explorer, and as an intelligent observer. Though in a playful mood Mr. Stanley had reproached him with having urged him to give them a geographical Paper, he believed the time would come when he would thank him for having done more to bring honour on his head than all his previous writing and speaking in this country. He deeply regretted that circumstances had prevented Sir Samuel Baker from attending, for he would have entered with a feeling of sympathy into the facts which Mr. Stanley had brought before them with so much clearness, judgment, and moderation as regards the claims of others. Only a day or two ago he received a letter from Sir Samuel Baker, in which he deplored very much that it was impossible for him to come up from the West of England to be present at the Meeting. It was also to be regretted that Sir Henry Rawlinson was unable to attend. He was sure it would have been a great pleasure to Mr. Stanley to hear the spontaneous and enthusiastic tribute of admiration which he would have paid to the admirable character of the Paper.

Mr. EDWARD HUTCHINSON drew attention to some sketch-maps which were exhibited on the table. They had been drawn by Lieutenant Shergold Smith and Mr. O'Neill, who recently met their deaths on the island of Ukerewe. They represented surveys made at the south-east corner of Victoria Nyanza. One important result obtained by these surveys and the other explorations of Lieutenant Smith was in connection with the subject of rainfall. It would appear that the rainfall in that part of Africa was so variable in amount in different seasons or years as totally to change the character of certain rivers. For example, it was at first supposed that the Wami River would afford a good water highway towards the centre of the continent. A little vessel was accordingly built for the purpose of surveying that river, and Sir Bartle Frere, when in Zanzibar in 1872-73, was kind enough to have a preliminary survey made; but the exploration by the agents of the Church Missionary Society showed that the river was utterly useless as a water way. A similar conclusion was arrived at with regard to the Kingani. The missionary boat, the *Daisy*, was then carried overland, and launched on the Victoria Nyanza. After visiting Uganda, and leaving one of their number with King M'tesa, the party returned to the south end of the lake in the month of June. They made their explorations of the rivers in that district in the dry season before the commencement of the "Masika" or rains. When Mr. Stanley saw the Shimeeyu it was a magnificent flood a mile wide; but when Lieutenant Smith saw it it was only 40 yards wide, and he said that at a distance of $4\frac{1}{2}$ miles up it could only have been navigated by a man in a

Boyton dress with waterproof boots. At that point the stream, which at flood time was 70 yards wide, was in the dry season entirely blocked by an elaborate system of stakes, with fishing nets extended right across. For 2 miles the Ruwana was fairly navigable, but beyond that it was only ankle deep. The eastern end of Speke Gulf was found just as Mr. Stanley had described it, a fringe of low-lying land. Mr. Stanley had very properly given Colonel Grant's name to a bay at the north end of the lake, and the Church Missionary agents had also given his name to the bay into which the Rugeshi Strait debouched on the north. With regard to the lowering or raising the Ripon Falls, it was an interesting fact that M'tesa had a notion that his importance and independence might be secured by entirely barricading the Nile, by erecting a vast dam across the Ripon Falls, so as to keep the Victoria Nyanza to himself. Whether that was likely to produce a result favourable to East Africa, he did not know; but when companies were formed for the purpose of flooding the Sahara, perhaps English capitalists might do something to help M'tesa to flood the lowlands to the east of Speke Gulf, and so bring the Indian Ocean nearer to the Victoria Nyanza. Mr. Stanley, with very creditable affection for the Livingstone, wanted to turn every river into it, but he (Mr. Hutchinson) objected to his turning the Uelle into it, because it was wanted for the system which drained into Lake Chad and the region of the Benue. The Lualaba and its tributaries were supplied from the very centre of the rainfall district, and what Mr. Stanley had said with regard to the 85,000 cubic feet flowing into Lake Chad might be accounted for in this way, that further north the rainfall was not so great. The Benue must come from somewhere, and he expected it would be found to rise on the northern side of those hills which seemed to bound the north-west course of the Congo.

COLONEL GRANT said Mr. Stanley's explorations in Africa seemed like a dream. First it was reported that he was on the Victoria Nyanza: months passed away, and then letters came from Ujiji. Then he was lost for eighteen months; and it was a great pleasure now to hear him giving an account of the journey he had performed. No doubt there was a great future opening up for Africa, from the vast resources of the water-communication that existed there. He had no doubt that what Mr. Stanley had said to-night would be an immense impetus to African exploration. Of course he had not been able to say much about the natives of Uganda, whom Speke called the French of Africa. Their kingdom was probably from 120 to 150 miles long. They were a very powerful nation. Egypt was pressing upon them from the north, but M'tesa, who had been visited by Speke and himself, and since then by Stanley and others, was in great hopes that he would get assistance from England from the east, and be able to hold his own against any aggression from the north. He was sure that if M'tesa was helped by England in any way he would assist in opening up the whole of the country, so that the southern routes might be connected with the Egyptian routes. He wished to thank Mr. Stanley for the handsome way in which he had spoken of his dear companion, Speke. Mr. Stanley had told them everything that they wanted to know as geographers, and his Paper would be a standard one in the Society's Transactions.

The PRESIDENT, in proposing a cordial vote of thanks to the author of the Paper, said that Mr. Stanley had it very much at heart to call the Congo the Livingstone. No doubt they would all feel much flattered, as Britishers, if the name of Livingstone were given to what appeared to be one of the most important rivers in Africa; but he (Sir Rutherford) thought that if any alteration were made, the river should be called the Stanley, for Mr. Stanley's name would be more inseparably associated with it than that of Livingstone or any one else. The Council of the Royal Geographical Society, however, had a strong objection to altering a name that had been current for the last

300 years. Livingstone's memory would go down to posterity without the aid of that river. He trusted that Mr. Stanley would forgive him for dissenting from him on that point, and that he would take in return his perfect admiration of the manner in which he had given them a model geographical Paper.

Mr. STANLEY, in reply, said he had the very smallest response to make to Sir Rutherford Alcock's observations. He regretted very much that the Council of the Society objected to calling the river the Livingstone, and not only he, but the youth of England, of France, of America, who had learned to admire a hero, regretted it. He was talking with a few young men the other day, and they said, "Why, what do the geographers mean by refusing to do that honour to poor Livingstone?" One of them was a young man from Cambridge, who had drawn around him a sympathetic coterie, a galaxy of stars who might some day be the lights of literature and of religion. They had been stimulated to admire a hero. Why should a fraud be perpetuated? Why should Sir Rutherford Alcock, the Council of the Royal Geographical Society, the travellers and the associates connected with them, perpetuate a fraud? Of course it was not an intentional fraud. That word "Congo" arose from a mistake. When Diego Cão came to the mouth of the river and asked the natives, "What is the name of this river?" they did not understand him, and he did not understand them. "That land," they said, "is Congo." They never said it was the river. Even at the present time the natives did not call it the Congo, but the Quango. Why then should science perpetuate a fraud? The aim of science was to crush fraud, and to establish right. Some persons seemed to feel an intense enthusiasm about the name Zaire, but what was there about that? "Zaire" simply meant "river." Before Livingstone went to the shores of Lake Bemba nothing was known about that broad river. It was known that Portuguese traders had said they saw a river called the Luapura, but where it went no one knew. Livingstone followed its course a short way and then returned to Ujiji. Stimulated by the few luxuries of civilisation which he (Mr. Stanley) gave him, he started back to follow it right down the Atlantic. But alas! his heart lay buried in the sedges of Bemba. Would the Royal Geographical Society now sacrifice such a hero because he was dead? Though his name would be perpetuated to eternity, yet let them lay their own little mite of tribute to his honour; let them throw their garland of flowers over the name of David Livingstone, and honour themselves in honouring him. Every other Geographical Society in Europe said the river ought to be called the Livingstone, because it was a mistake of a poor Portuguese navigator to call it the Congo, and other travellers had perpetuated the mistake. It was different with the Nile. No one would dare to discredit that name, or to put a parvenu title to that grand old river of Egypt. But was there any history attached to the Congo? Yes, the history of the man who had consecrated that Lake Bemba, so that every explorer with a drop of the blood of the race of Japheth, as he stood by the humble tomb of Livingstone, would bend and reverence the name. He asked the Royal Geographical Society not to perpetuate a fraud, but to honour themselves by honouring the name of Livingstone.

Fourteenth Meeting, 24th June, 1878.

FRANCIS GALTON, Esq., F.R.S., in the Chair.

PRESENTATION.—*John Eduard Ward, Esq.*

ELECTIONS.—*William Abbott, Esq.* ; *Donald Baynes, Esq., M.D.* ; *Sir Arthur Blyth, K.C.M.G.* ; *Rev. Charles Heaven, M.A.* ; *Major-General Sir W. Drummond Jerrois, C.B., G.C., M.G.* ; *Dr. George Suiche* ; *Dr. Jean Jacques Wild.*

DONATIONS TO THE LIBRARY, JUNE 3RD—24TH, 1878.—*Manual of Surveying for India, 3rd Ed., by H. L. Thuillier and R. Smyth* ; Calcutta, 1875 (*General Thuillier*). *Observaciones astronomicas y phisicas . . . de las quales se deduce la figura de la Tierra, por J. Juan y A. de Ulloa* ; Madrid, 1773 (*J. P. Gassiot, Esq.*). *Registrande der geographisch-statistischen Abtheilung des Grossen Generalstabes, viii., 1878, pt. 2 (The Chief of the Prussian General Staff)*. *Meteorology of the Bombay Presidency, by C. Chambers, 1878 (H.M. Secretary of State for India)*. *Report on the Laccadive Islands, by W. Robinson* ; Madras, 1874 (*The Madras Government*) *Memoirs of the Geological Survey of India, Series ii., 3* ; *Series iv., 2* ; *Series x., 3* ; and *Series xi., 2 (H.E. The Governor-General of India in Council, per H. B. Medlicott, Superintendent of Survey)*. *U.S. Geological Exploration of 40th parallel, vol. iv., 1877 (Clarence King, Geologist in charge)*. *U.S. Geological and Geographical Survey of the Territories* ; *Illustrations of Cretaceous and Tertiary plants of the Western Territories, 1878 (Dr. F. V. Hayden, Geologist in charge)*. *U.S. Hydrographic Office publication, No. 38 (The Office, per Commodore R. H. Wyman)*. *Sketches of African Scenery from Zanzibar to the Victoria Nyanza, by T. O'Neill, 1878 (The Church Missionary Society)*. *Notes on individual equipment for the East, by T. Fraser, 1878 (Author)*. *La nouvelle Société Indo-Chinoise et l'Art Khmer, par M. Legrand* ; Paris, 1878 (*Author*). *Notes from the East Coast, descriptive of a trip to Zanzibar and back, by R. Vause* ; Natal, 1877 (*Author*). *Cinchona* ; *Arten, Hybriden und Cultur der Chininbäume, von O. Kuntze, Leipzig, 1878 (Author)*. And the current issue of publications of corresponding Societies, periodicals, &c.

DONATIONS TO THE MAP-ROOM, FROM JUNE 3RD TO JUNE 24TH, 1878.—*Sketch Map of New Zealand, showing the land tenure, August, 1877 (James Harvey, Esq.)*. *Admiralty Charts, 28 sheets (The Hydrographer)*.

The CHAIRMAN said the Lecture to be delivered, which was the third and last of the Science Lectures of the Session, would be on Plant-Distribution as

a Field for Geographical Research, and would be delivered by Mr. Thiselton-Dyer. It was hardly necessary for him to say many words in introducing Mr. Thiselton-Dyer to the Meeting. His name was well-known in scientific circles, as that of one of our younger botanists of high repute. The position he filled at Kew could not be creditably filled except by a botanist of great ability. It was a post which gave the person who held it opportunities of learning the most recent facts of Geography, so that he could point out better than any one else what were the botanical *lacunæ* which travellers should endeavour to fill up. The Paper would contain remarks on the method of gathering information concerning economical products of different countries, and few persons were better qualified than Mr. Thiselton-Dyer to deal with that subject, for to him had been practically entrusted for some time past the scientific revision of the unrivalled Museum of Economic Products at Kew.

Lecture on Plant-Distribution as a Field for Geographical Research.

By W. T. THISELTON-DYER, M.A., B.SC., F.L.S., Assistant-Director,
Royal Gardens, Kew.

WHEN the scheme of these discourses on scientific geography was first announced, I must confess that I looked forward to that which I am myself about to deliver with very different feelings; for I certainly supposed that we should have had the advantage of hearing some one of the botanists of this country, whose well-known and long-continued devotion to the subject would have made it easy to handle it in a masterly way. Mr. Bentham, for example, would have brought to it the matured results of many years' reflection in a field which he has made peculiarly his own, as well as the authority which must attach to the generalisations of one who has worked out and published the taxonomy of a greater portion of the earth's vegetation than any other living botanist. Sir Joseph Hooker, no less a master of the speculative side of the subject (if, indeed, we do not owe to him our first steps in the direction of its modern progress), would have imparted to you the vivid impressions of different areas of vegetation, of which I am not aware that any living botanist has actually seen so many. And my colleague, Professor Oliver, in his turn, would have brought to the task a unique qualification, for I can hardly suppose that any botanist has ever critically examined, in the shape of herbarium specimens, so much of the flora of the whole world as he must have done. None of these gentlemen, however, were disposed, from the pressure of other engagements, to undertake the task which has fallen upon me, and which I confess I have accepted with no small anxiety; for I am very desirous of securing your sympathy and, I hope, your co-operation as a society in a branch of scientific work, in which I think England at present stands quite in the first rank.

To fix our thoughts, let us suppose for a moment that the

surface of the globe were symmetrically divided into sea and land, and that these were in fact distributed in bands bounded by parallels of latitude. Supposing further, that such a state of things could be permanent—which I imagine it could not be—we should have the physical conditions of vegetable life uniform for each latitudinal zone. The character of the vegetation would depend on temperature alone; and as regards its aggregate mass, we should find it attaining its maximum at the equator, and sinking to its minimum at the poles. It is quite certain, however, that under such ideal circumstances the earth's vegetation would be very different to what it is, and the reason will be apparent enough on a little reflection. Looking at a map of the world, we see that the actual distribution of land and water is as unsymmetrical as it well can be, and we know that this geographical asymmetry is correlated with a no less striking diversity in climate. Vegetation in any given spot maintains its own only by having solved the problem of existing in the best way under the given circumstances. Introduce a new competitor for a particular site that can solve the problem rather more closely, and the old occupant must needs give way. It is quite evident, then, that the geographical intricacy, whether of outline or contour, in the existing land-surface must be matched by the elaborate diversity of its floral covering, and that any easily recognised broad areas of uniform vegetation will be sought for in vain.

And as far back as we can push our inquiries the same state of things obtained. The main features of the great continents and oceans, whether in the old or new world, seem to have been permanent from the earliest geological time;* but their minor details have enormously varied. The mutations in level of the surface have severed and united different land areas again and again, and have consequently isolated or blended their respective floras. Great secular changes of climate have also forced the migration and re-migration of floras which have moved as the conditions under which they can exist have moved. Isolation on the one hand, and migration on the other, have heavily decimated them; and when we meet with a plant which seems to have no close family allies, but to stand alone in peculiarities of structure, we recognise it as the last survivor of its group in some contracted area from which there was no escape from more powerful competitors or unfavourable conditions, or as having been the only

* See Dana, 'Manual of Geology,' p. 732; Wallace "On the Comparative Antiquity of Continents," 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 508.

one able to triumph over the innumerable obstacles in the way of its transit from its old home to its new.

The modes of transference of plants from one part of the earth's surface to another fall into two great categories. The normal dispersion, whether by the aid of winds, migratory animals or rivers and oceanic currents, must be, roughly speaking, a latitudinal one, and tend to intermingle floras which, though differing in themselves, live under very similar conditions at the same time. Secular changes of climate will act along lines at right angles to the former agencies—meridionally, in fact—and will therefore effect the substitution of very different floras; and if, when the changes have been reversed, we find fragments of the migrating flora left behind, it is only in sheltered valleys or in proximity to the sea in the case of a colder climate than that they came from originally, or on high mountain ridges in the case of a warmer one. These great longitudinal migrations—enormous as must have been their effect in changing the vegetative aspect of the earth's surface—have not done much in mixing the floras of *laterally contiguous* continents. The great hosts of plants have oscillated between the poles and the equator, and the friction attendant on their movement—if I may use such an expression—has thinned their ranks, and perhaps extinguished whole battalions; but the plants which we see to-day are to an enormous extent the descendants of those which in an antiquity not to be measured in terms of ordinary time inhabited the same great land-surfaces.

Considerations of a similar kind having gradually led to the philosophic treatment of the facts regarding the distribution of animals, I believe that we shall be able to work out those regarding plants in ultimate accordance, and find, to use the words of Mr. Wallace, that “the great primary divisions of the earth for purposes of Natural History correspond with the great permanent features of the earth's surface—those that have undergone least changes in recent geological periods. Later and less important changes will have led to discrepancies in the actual distribution of the different groups, but these very discrepancies will enable us to interpret those changes, of which they are the direct effects, and very often the only evidence.” . . . “The flora of each region should exhibit a characteristic substratum of indigenous forms, though often much modified, and sometimes nearly overwhelmed by successive streams of foreign invasion.”* “Naturalists,” to quote Mr. Wallace again, “need not be bound by the same rule as

* ‘Natural History Review,’ 1864, pp. 122, 123.

politicians, and may be permitted to recognise the just claims of the more ancient inhabitants and to raise up fallen nationalities. The aborigines, and not the invaders, must be looked upon as the rightful owners of the soil, and should determine the position of their country in our system of zoological"—to which I must no less add, of botanical—"geography." *

Now, however efficiently a scientific botanist may study the plants of a country, in which he happens to be residing, in the living state, it is clearly impossible that they can be compared with those of other countries unless specimens can be preserved suitable for examination, and deposited in some central situation available to students. From this necessity has gradually grown up at Kew, as elsewhere, the immense Herbarium which is so important a feature in our organisation at the Royal Gardens, and which I imagine I am not influenced merely by feelings of official pride in stating to be the most extensive in existence. A Herbarium in modern times is not a thing got together from the mere blind passion of accumulating rare and curious things, but is an instrument of scientific investigation—a method of bringing together in a convenient space the materials for studying and comparing the constituents of the world's vegetation.† It is composed of contributions large and small, brought together from the most diverse sources. It consists in the main of large collections due to the energy of our Indian and colonial botanists and which we owe to private liberality or have received from their several governments, of collections made by botanists in foreign countries and which we have obtained either by purchase or exchange, of others made by great travellers such as Burchell and Spence and which in various ways have come into our possession, and lastly of an innumerable host of contributions sent to us by correspondents in all parts of the world.

In fact there is no contribution, however small, which we are not prepared to thankfully accept from any country—and how many there are—the vegetation of which is still imperfectly explored! Except perhaps insects, there is no class of natural-history objects which it is so easy to collect and preserve as plants. Any ordinarily intelligent person could in ten minutes learn all the

* Wallace, *l.c.*, p. 119.

† How real is the advantage of centralisation in such scientific studies is proved by the fact that Dr. Brandis, the Inspector-General of Indian forests, found it necessary to come to this country to spend two years in preparing at Kew, rather than in India, his Indian Forest Flora.

technical points which must be attended to in securing a specimen fit for botanical study. When once properly pressed and dried, botanical specimens are subject to no injury except from damp. The superb collections, to take only a few recent examples, made by Beccari in Borneo, Schimper in Abyssinia, Welwitsch in Angola, Grant* and Schweinfurth in Central Africa, show how little obstacle the difficulties and impediments of travel in even trackless and unexplored countries really oppose to an enthusiastic and determined naturalist.

Our correspondents in countries where botany is at present little known generally labour under the disadvantage of being settled near the coast, with the rarest possibilities of getting access to the interior. What we do get from them only stimulates our curiosity and desire for more. Our indefatigable correspondent Dr. Kirk, the political agent at Zanzibar, never misses an opportunity of securing for us anything upon which he can lay his hands in the shape of a new African plant. Thus when Mr. New, the African Missionary, unhappily since dead, projected an ascent of Kilima Njaro, the loftiest African mountain, and the snow-line of which, as far as I know, had never been reached by a human being before, Dr. Kirk, in sending him letters to the chiefs he would pass on his way, asked him in return, as a favour, to cram into any old book what he could of the highest vegetation of the mountain. Mr. New had never dried a plant in his life, and had no apparatus available for the purpose other than a bundle of old 'Guardians.' Yet he succeeded in obtaining for us specimens of about fifty species, the examination of which yielded results of the very greatest interest and importance.† To mention one result alone, he found on this mountain a plant which is not known to occur elsewhere in Africa than on the Cameroons, 2000 miles distant, and the significance of which I shall have by-and-by to advert to.

* The botany of the Speke and Grant Expedition fills the whole of the twenty-ninth volume of the 'Transactions of the Linnean Society.' I cannot do better than quote, as an encouragement to future travellers, the modest words in which Colonel Grant commences his account of his collections: "It occurred to me that many a pleasant hour might be spent in collecting plants and seeds while traversing the country to be explored. I here confess that I did not then anticipate any botanical importance from such a collection. With this idea (more of pleasant occupation than of scientific result), before embarking at Plymouth I purchased some drying paper and a couple of books for notes, all for a few shillings. When Captain Speke saw this bundle of paper, he thought it far too cumbersome for such a journey, but he readily yielded to my wish to have it. He afterwards saw how the plants were appreciated, when we took them to Kew upon our return."

† J. D. Hooker, "On the Subalpine Vegetation of Kilima Njaro," 'Journal of the Linnean Society,' vol. xiv., pp. 141-146.

To take another instance. Since the end of last century it has been known that the island of Amsterdam, in the South Indian Ocean, was covered with trees; and though the desirability of ascertaining the nature of this arboreous vegetation has often been impressed on the commanders of ships about to visit the Southern Ocean, nearly three-quarters of a century elapsed before the wished-for information came. The late Commodore Goodenough touched at Amsterdam Island in 1873, and brought off a specimen of the only tree in the island (to which the forest described by Labillardière had been reduced), together with a fern in an imperfect state, and an armful of cabbages pulled from the deserted garden of departed whalers. The tree proved to be identical with *Phyllica arborea* (Thouars), known previously only from Tristan d'Acunha—a most astonishing fact, seeing that these two oceanic specks of land are separated by 3000 miles.* A last case, which I cannot pass over, is that of perhaps the only natural-history specimen yielded by the Ashanti War. Lieut. de Hoghton brought us a single fruit, which turned out to belong to an undescribed species of *Duboscia*, known to us previously only by specimens gathered on the River Muni by Mr. Gustav Mann.† Invaluable, however, as are such happy scientific windfalls as these, I think I shall succeed in showing you that what is wanted in the present state of botanical science are collections, systematically made, from the interior of countries, the botanical productions of which are still almost wholly matters of conjecture.

I feel, however, that I shall not be stating my case with entire fulness if I omitted to point out that while botanical collections are indispensable for the study of phyto-geography, a herbarium such as we possess at Kew renders great services for other purposes. The botanical determination of a plant is nothing more than the process of affixing to it a name which shall pass current in all countries to which scientific literature has access, and which we can recognise as belonging to the species by virtue of the distinctive characters which it is the business of the botanist to point out. At present, however, from a variety of causes which it is now unnecessary to discuss, the literature of systematic botany, as indeed of all the descriptive sciences, is in a very scattered condition. It is not always easy for even botanists in foreign countries to correctly name their plants, and it requires the resources of a central establishment, such as we possess in Kew, to accomplish this with any certainty; more especially if the

* 'Journal of the Linnean Society,' vol. xiv., p. 475.

† Ibid., p. 457.

material to work upon is, as is too often the case, fragmentary. I might occupy a good deal of your time, and perhaps in a not uninteresting manner, if I were to enumerate more than a few of the cases in which the services of the botanist have been of importance from a merely commercial point of view.

The botanical determination of the existence of the indigenous tea-plant in Assam, initiated the commencement of Indian tea-cultivation.* In what promises to be another great branch of Indian industry—the cultivation of Cinchonas, the botanical determination of the valuable species has been all important. None have felt this more than the Dutch, who introduced a worthless species (*Cinchona pahudiana*) at great cost into Java, the cultivation of which they had eventually to abandon. To point to more recent instances which fall within my knowledge, I may mention that after the India Office had gone to great expense in bringing over to this country for introduction into India, the true plant which yields Para India-rubber, we learnt that one bearing the same scientific name (*Hevea*) was already in cultivation in the botanic gardens of the East. On obtaining authentic specimens, we were able to ascertain that, though a rubber-producing plant, it was really quite different from that of Para, and so disappointment and confusion were obviated. To take some minor instances—a substance called Chicle-gum was sent to us from America as likely to be of use in telegraphic engineering. Had it proved of any value—which it did not—in ascertaining the fact that it was produced by a widely cultivated tropical plant (*Achras Sapota*) we should have been able to introduce a new industry into countries where the Sapodilla plum already grows. A grass (*Uniola virgata*), again, was sent to us from the West Indies as a proposed paper-material. Grasses are so much alike in leaf and stem, that but for a fragment of the inflorescence we could not have identified the species. When this was done, residents who are acquainted with the plants of Jamaica would have no difficulty in knowing where to find it, and if it proves worth while, can cultivate it for the purpose. As a final instance, let me take the introduction of a new drug (*Duboisia myoporoides*) which we owe to Baron von Mueller. The natives of Central Australia have long been known to chew a plant which they call Pituri, which invigorates them on long foot journeys, and excites their courage in warfare. Baron von Mueller succeeded in identifying this plant as *Duboisia Hopwoodii*. This led him to

* A. Burrell, "Indian Tea Cultivation," 'Journal of the Society of Arts,' vol. xxv., pp. 206, 207.

test the properties of another species, *Duboisia myoporoides*, which he found to possess, amongst others, that of dilating the pupil, for which purpose it is already in use in ophthalmic surgery.* .

Even where travellers are unable or disinclined to collect on a considerable scale, it is remarkable how much useful work they could do by finding out and securing specimens of any plant whose products they found in use amongst the natives—just as Baron von Mueller succeeded at last in doing with the Pituri. When a botanist has possessed himself of a recognisable specimen of a plant, he is able to record for all time the useful properties which native tradition has attributed to it, and which, as native customs and habits become restricted and disappear, run the risk of being for ever buried in oblivion. In the immense collection which we possess at Kew illustrating the useful products of the vegetable kingdom, there are a multitude of specimens—fibres, gums, resins, barks, seeds, &c.—all interesting, and yet to the origin of which we have no clue, and which therefore we should have no idea how or where to find, however anxious we might be to get further supplies of them.

And even of things which find their way into commerce, our ignorance of the source is often remarkable. Till within the last few years, it was supposed, on the best authority, that the well-known kinds of tobacco grown at Lattakia and in Cuba, were the produce of some other species of *Nicotiana* than *N. Tabacum* which really yields them. St. Ignatius's beans, which find their way into the markets of this country as a source of the deadly poison, strychnine, are the seeds of a fruit which is said to be sold in the market at Manila, and there our knowledge stops. The various kinds of Cardamoms, which are found in Eastern trade, are the seeds of plants most imperfectly known, though some species grow in forests under the charge of Government officers. When we approach China we find, as we might expect from the sagacity of that ancient people, that the vegetable products in use amongst them are very numerous, but that the origin of them is very little known amongst Europeans. It required all the energy of Sir W. Hocker to urge his correspondents during several years to trace out the history of the plant whose pith is the material of rice-paper, and which is confined to the island of Formosa.† It was reserved for Lieut.-Col. Prejevalsky, as the crown of his adventurous journey to Lake Koko-nor, to settle finally the controversies as to the source of true or Kiakhtha rhubarb, and to study the real plant

* 'Nature,' May 24. 1877.

† 'Journal of Botany,' 1852, pp. 50-54.

producing it (*Rheum palmatum*) on its native soil; being, says Colonel Yule, "the first European who had seen it there since Marco Polo."*

During the course of last year the attention of the Indian Forest Department was attracted by the high price given at Shanghai for coffins made of Nan-mu wood. Of the same wood the Imperial palaces at Peking are also said to be built, although travellers were quite content to believe they were constructed of teak, just as antiquaries have held, and with as little accuracy, that the oaken roofs of our ancient buildings were made of chestnut. This tree appears to be indigenous to Yunnan; and a few leaves collected by Mr. Davenport during the mission to that country, and examined by my acute colleague, Professor Oliver, have rendered it probable that this celebrated timber-tree is at any rate a member of the Laurel family, and possibly allied to *Phoebe pallida*, with whose foliage its own closely agrees.

However, I fear I have too long trespassed on your patience in endeavouring to illustrate by example, as well as precept, the immense services which the "roving Englishman," and still more the disciplined explorer, might render to that practical side of botanical studies, which at Kew we never lose sight of for a moment. All economic plants, whose range is at all contracted, progress steadily towards extinction,† and the first step in attempting to obviate this by bringing them under cultivation is to make quite sure that we have got hold of the precise plant which produces the thing of which we wish to keep up the supply.

* Prejevalsky's 'Mongolia,' translated by E. Delmar Morgan, vol. i., p. xxxi.

† This is so invariably confirmed by experience that illustrations are hardly needed. A few examples will at any rate sufficiently point the moral. The Akyaw of the Burmese is a resin which is obtained from the wood of trees growing in the Mergui Archipelago when it has begun to decay. It finds its way to China, where it is greatly in demand for incense and other purposes. It has been supposed to be identical with the "aloes" of the Bible. From the Report of the Forest Department in British Burma for 1876-7 (pp. 20-23) it appears that there has been "a great diversity of opinion respecting the number of species of trees which yield the Akyaw"; the native collectors distinguish two kinds of trees, but these at present, from want of flowering specimens, have not been accurately identified botanically. Nevertheless "the margins of the forests have already been cleared, and the extermination of the tree in all readily accessible places is only a question of time." The history of the valuable Rubber-vines (*Landolphia*) of Tropical Africa is precisely parallel. Mr. Sketcheley states that the natives, "rather than take any extra trouble, ruthlessly destroy every vine for the sake of obtaining a single supply of the elastic juice. The result is that, vast as is the area over which the rubber-tree is found, the natives, who alone are the producers, have to penetrate deeper and deeper into the forests for each year's supply." The large tea-trees of the Naga Hills—some of which are said to be three feet in girth and eighty feet in height—are rapidly disappearing, being cut down for firewood, or to save trouble in gathering the seed. ('Report of Forest Department in Assam,' 1876-7, pp. 29, 30.)

I must now attempt to point out to you the more abstractedly scientific problems to the solution of which we, whose business it is to work out the materials we receive, stand very much in need of aid; and I can only do this by stating, as briefly as possible, the present results which we have acquired, and the serious gaps in our knowledge will then speak for themselves.

The most superficial study of the vegetation of the world brings almost immediately into prominence its division into three great floras, of which, speaking very roughly indeed, we may say that the tropics are the frontiers. That these are but differentiated portions of one sheet of vegetation, formed by the aggregate twigs of one great genealogical tree, having a single root in the distant past, we infer from the general theory of evolution; and we are no less led to it by the internal evidence afforded by the more detailed study of the floras themselves. But we may be quite sure that these great divisions are very ancient, and at present we have not proceeded very far in clearly apprehending the relation of the several subsidiary areas of vegetation which belong to each.

I. The NORTHERN Flora is characterised by forests of needle-leaved *Coniferae* and catkin-bearing trees (*Amentacea*) shedding their leaves in winter, and by the vast variety of herbaceous plants—*Ranunculaceae*, *Cruciferae*, *Leguminosae*, &c.—which cover the surface of plains and uplands. This great flora spreads over the whole of the extra-tropical lands of the northern hemispheres in the Old and New Worlds.

II. The SOUTHERN Flora is markedly contrasted with the Northern. Instead of occupying large continuous areas, in which the local peculiarities of one district blend insensibly into those of another, it occupies widely-dissevered territories, in which local peculiarities, intensified by long separation, have mostly effaced the possibility of comparing and identifying species and even genera, and compel us to seek for points of contact in the comparison of groups of a higher order. The resemblances consist, in fact, not so much in the existence of one general facies running through the regions, as is the case with the Northern flora, but in the presence of peculiar types such as those belonging to the families *Restiaceae*, *Proteaceae*, *Ericaceae*, and *Mutisiaceae*.

III. The TROPICAL Flora is characterised by the absence of herbaceous and the predominance of arborescent * types, which rarely

* A striking instance of the poverty of tropical floras in herbaceous types is afforded by the distribution of *Compositae*, which are most poorly represented in the Brazilian and Malayan forests (see Bentham, 'Journ. Linn. Soc.' xiii., pp. 484, 524, 546). Beccari's collection of 1849 Sarawak plants contained only six *Compositae*, several mere weeds.

shed their leaves. Polypetalous orders abound (*Anonaceæ*, *Meliaceæ*,* *Leguminosæ*, &c.), and amongst Monocotyledons, Palms,† Plantains (*Scitamineæ*) and gigantic grasses (*Bambusaceæ*) are especially conspicuous.

I. THE NORTHERN FLORA.—This is by far the most widely-extended of existing floras, and palæontological evidence appears to show that its uniformity has been even greater than it is at present, when the complete severance of its New and Old World divisions, and the severe segregation which each underwent during the glacial period, has brought about some considerable divergences. Lesquereux finds the essential types of the present arborescent flora indicated in the North American cretaceous rocks, and more distinct and numerous in the tertiary.‡ Hence he infers that the origin of the existing American flora is American. And as we seem to be justified in admitting the existence of a marked analogy between the Miocene flora of Central Europe and the present vegetation of North America, which is undoubtedly greater than between the same fossil flora and that now existing in Europe, we may accept Lesquereux's conclusion that the American element in the vegetation of Miocene Europe was derivative. In the Old World, in its most characteristic forms, it has now faded away in the West; and, which is due probably to very different causes, it is now also most predominant in the Eastern rather than the Western States of North America. We owe, in fact, to Asa Gray one of the most interesting achievements of the modern study of Geographical Botany, in establishing the remarkable result that the flora of North-east Asia has more affinities with that of North-east than that of North-west America.§ In both what may be called the Miocene facies of the flora is better preserved. Oliver has, however, shown that proceeding westward in the Old World from Japan, through Northern China and the Himalaya, and thence through Persia to the Mediterraneo-Caucasian region, we trace the stragglers of the retreating Miocene host in *Chamærops*, *Platanus*, *Liquidambar*, *Pterocarya*, *Juglans*, &c. || Amongst specific types actually common to North America, Japan, and the Himalayas, may be mentioned *Aralia quinquefolia*, *Phryma leptostachya*, and *Trillium erectum*.

* "On the Distribution of *Meliaceæ*," see C. De Candolle, 'Trans. Linn. Soc.,' second series, vol. i., pp. 233-236.

† "On the Distribution of Palms," see O. Drude, Petermann's 'Mittheilungen,' 1878, p. 16.

‡ 'Geological Survey of Montana,' 1871, p. 314

§ 'Memoirs of American Academy,' vol. vi., pp. 377-458 (1859); 'Darwiniana,' pp. 219-224. Grisebach's attempt with little success to explain away Asa Gray's facts is discussed by Bentham, 'Presidential Address to Linnean Society,' 1872, pp. 5-7.

|| 'Natural History Review,' 1862.

In determining the subsidiary divisions of so vast a flora, extending from far within the Arctic circle to the tropic, we are not surprised to find that physical conditions play an important part in effecting the differentiations which make it possible to draw the boundary-lines. Looking at the northern continents, we are struck with the wide difference in the arrangement of the prominent elevations and corresponding depressions. In the Old World we see great latitudinal barriers in the vast mountain-ridges which run from east to west, and which are flanked in the latter direction by the chain of seas from the Aral to the Straits of Gibraltar. In the New World there are no such barriers, and the mountain-ridges take an almost meridional direction. During the glacial period, when the northern flora was driven down southwards, and still more when it slowly returned from its exile, the course of the migrating streams must have been powerfully controlled by the nature and position of the obstacles placed in their way; and the object of our present studies of this flora—of which the actual component species are now, no doubt, pretty well known—must be to try to unravel the complications of its existing distribution in the light of physical geography.

The secondary floras, which may be distinctly recognised, are the following:—

1. The *Arctic-alpine*, consisting of races of plants belonging originally to the general flora, and recruited by subsequent additions, which have been specialised in low stature and great capacity of endurance to survive long dormant periods sometimes even unbroken in successive years by the transitory activity of the brief summer.

From the interesting collections made by the recent Arctic Expedition, it appears that the Arctic flora extends to the most northern lands at present known. On May 30th, in Ward Hunt's Island, lat. $83^{\circ} 5'$, "vegetation was fairly represented as regards quantity in the poppy, saxifrage, and small tufts of grass."* At the winter quarters of the *Alert*, in lat. $82^{\circ} 25'$, Sir George Nares gives an interesting account of the brief summer aspect of the vegetation. On July 29th, "The purple carpet of saxifrage profusely spread over the ground . . . lasted only for about ten days. It has now given place to the bright yellow ranunculus and *Draba*, with a rich sprinkling of the more delicate tinted poppy and mountain avens, and a small yellow saxifrage."† In $81^{\circ} 4'$, Sir George Nares describes the vegetation on the southern slopes of Bellot's Island as remarkably rich. "Six species of saxifrage were common; and the

* Nares, 'Voyage to the Polar Sea,' vol. i, p. 32.

† Ibid., l. c., p. 78.

beautiful *Hesperis*, with its lilac blossoms, attained a height of eight or ten inches; considerable patches were also covered with *Androsace septentrionalis*, and a single species of fern grew abundantly under the shelter of boulder rocks." He concludes, "that a favourable combination of soil, shelter from winds, and full exposure to the sun, have more to do with the development of flowering plants in the polar regions than parallels of latitude."* From a review of the whole collection,† Sir Joseph Hooker deduces some interesting conclusions, which are in complete agreement with his previous examination of the general distribution of Arctic plants.‡ He finds "that the vegetation of this meridian of the polar area is entirely Greenlandic, showing no further relation than does Greenland itself to the floras of the American polar islands to the west of it, and of Spitzbergen to the east of it.§

This northward extension towards the pole of the Greenlandic flora, unmixed with the polar island and Spitzbergen floras on either side, is a remarkable instance of meridional distribution in an area where, from the restricted size and apparent general uniformity of physical conditions, it would scarcely have been anticipated. How little justified we are even under such exceptional conditions in assuming anything like vegetative uniformity under the same latitude is clearly shown by the contrast between Grinnell's Land and Franz Josef's Land, the "brilliant assemblage of gay-coloured flowers, the resort of butterflies and bees," of the former contrasting most strikingly with the rare and isolated patches of the latter.|| It is of course obvious that within the existing limits of the Arctic flora there can be practically no diffusion and intermixture of its constituents. During the glacial period, however, when the flora proceeded southward, it would be liberated from its narrow bonds, and extend its area, and produce new races and varieties. When it retreated again northwards, the detachments travelling backwards, along great meridional zones in Europe, Asia, and in North America, would have acquired a local colouring, partly due to variation during their migration, and partly to the elimination of some of

* Nares, 'Voyage to the Polar Sea,' *l. c.*, p. 140.

† A list of the species of flowering plants collected by the naturalists of the expedition is given in the appendix to Sir George Nares's book (vol. ii., pp. 310-312). It would certainly have added to the interest of these important gatherings, made over five degrees of latitude, if the localities had been appended to the names of the species. In lat. 82, in the vicinity of Discovery Harbour, a very interesting collection of Miocene fossil plants was made (vol. ii., pp. 333-335). This is the most northern evidence we at present possess of the Arctic extension of the Miocene flora. It included *Taxodium distichum*, the genus being now confined to Mexico and the south of the United States.

‡ 'Trans. Linn. Soc.,' vol. xxiii., p. 253.

§ Hooker in Nares, *l. c.*, vol. ii., p. 301.

|| *Ibid.*, *l. c.*, vol. ii., p. 307.

the constituents and the addition of new ones. The isolated colonies left behind on mountain ranges towards the south would, compared with one another, reflect the same diversities as the sections of the Arctic flora belonging to the same meridians do now in a narrower compass.

2. The *Temperate* or *Intermediate* flora is the name which Bentham has given to the vegetation of the large areas which are occupied by Grisebach's Prairie region of the new world, Steppe region of the old, and Forest region of both.

In the Old World I have already pointed out how completely the old Miocene vegetation has disappeared in Northern Europe and Western Asia. The existing vegetation is probably almost entirely post-glacial and Eastern in origin. The oak (*Quercus Robur*) has left no trace in the tertiary deposits of Europe, and its starting point is to be sought eastwards.* Successive waves of vegetation have rolled towards the west; even now that represented by the oak is in its turn losing, and the more recent one, represented by the beech, is gaining ground.

In the New World we are struck with the remarkable diversity between the floras of the Pacific and Atlantic States. California has no beech, chestnut, hornbeam, birch, lime, locust, hickory, elm or mulberry. And Sir Joseph Hooker has shown in a recent lecture, in more detail than I can refer to here, that the general features of vegetation in North America run parallel to the mountain ridges which, as we have already seen, take a meridional course. He has shown good reason for supposing that when, during the glacial period, the Miocene vegetation was driven downwards into Mexico, the valleys parallel to the Pacific coast were still filled with ice when the tide again began to turn northwards and the whole stream was consequently deflected to the east. When the western valleys were at length unlocked, they could only be supplied with a vegetation of a more Mexican type.

3. The *Mediterraneo-Caucasian* flora contrasts no less vividly with the Intermediate flora than the Arctic-Alpine. Its extreme richness in number of species (it comprises six-sevenths of the European flora), and the extremely restricted areas of many of them, both point to a great antiquity. In fact there is reason to believe that the flora of the Mediterranean basin has been a centre of preservation ever since the Miocene period.† The oleander is

* Asa Gray, 'Darwiniana,' pp. 186-189.

† A conclusion to which Mr. Ball is also led on other grounds. See the introduction to his "Spicilegium Floræ Maroccanæ," 'Journal of the Linnean Society,' vol. xvi., p. 302.

said to be found there in local deposits of an even earlier age,* and the evergreen oak is probably the living representative of a Miocene ancestor.† Under the influence of a colder climate the southern extension of this flora, now limited by the African and Arabian deserts was considerably greater. *Adeocarpus*, a characteristic Mediterranean genus, is represented by an identical species discovered by Mr. New on Kilima Njaro, near the equator, and on the Cameroons mountains, 2000 miles distant on the opposite and western side of the African continent.‡

Eastward, the Mediterranean flora reaches its limit in Scinde, and the temperate flora of Asia is only separated from the tropical by the Himalayas. Some of the peculiar Mediterranean types reappear after a long gap in North Eastern China. Amongst these are *Liquidambar* and *Pistacia*,§ both of which are found in Mexico—*Pistacia* not being known elsewhere in the New World. Mexico, indeed, in some respects, plays in it the part of the Mediterranean region. Further investigation will doubtless detect in it many remains of the old Miocene flora once common to the whole northern hemisphere, which driven down during the glacial period, have never succeeded in retracing their steps. Mr. Hemsley has obligingly pointed out to me two striking cases in *Deutzia* and *Abelia*, two Indo-Chinese genera, unknown elsewhere in the New World.

II. THE SOUTHERN FLORA.—The problems presented by the philosophical study of the southern flora have lost none of the fascinating interest with which the classical essays of Sir Joseph Hooker, published twenty years ago, at once invested them. Biological investigations will always attract us in proportion to their difficulty, and I know none which is more worthy of attention than the distribution of vegetable life in the Southern Hemisphere.

I have already indicated the remarkable points in which the southern and northern floras contrast. A further difference, with which I am much impressed, but about which I desire to speak with diffidence, is the relatively greater antiquity of the former. To the southern hemisphere (although not entirely to the Southern Flora) belong the majority of living species of *Cycadeæ*, a group of plants which flourished in Europe in the oolitic epoch, and as to the extreme antiquity of which morphological, no less than palæontological, evidence bears conclusive testimony. The species

* Martius, 'Mém. de l'Acad. des Sc. de Montpellier,' vol. ix., p. 95.

† Asa Gray, 'Darwiniana,' p. 189.

‡ Hooker, 'Journal of the Linnean Society,' vol. xiv., p. 144.

§ Hance, 'Journal of Botany,' 1873, pp. 169-172.

of *Araucaria* also, which carry their archaic character unmistakably in their habit and aspect in European gardens, have been, as far as we know, extinct in the wild state since the oolitic age north of the equator. Now they are a distinctive feature in Australian and extratropical South American vegetation. Lastly, South Africa possesses in *Welwitschia* a vegetable type whose extraordinary peculiarities make it seem amongst contemporary vegetation much as some strange and extinct animal form would if suddenly endowed with life.

1. The *Australian* flora has the first claim on our notice, as there is no area of vegetation, equal in dimensions, which has been worked out so completely or in so masterly a manner as that of the great island-continent by Mr. Bentham. This enormous undertaking, of which the seventh and concluding volume appeared at the commencement of the present year, is, as far as I know, unique in botanical literature. It enumerates and describes, with all the acuteness brought to the task by the greatest living systematist, the immense stores of Australian species of plants which have been accumulated in European herbaria by the indefatigable labours of a long series of collectors, explorers, and botanists, beginning with the memorable names of Banks, Solander, and Robert Brown, to terminate with that of the distinguished botanist Baron von Mueller, who has been associated with Mr. Bentham in its preparation, and without whose unparalleled energy in collecting and critically studying the vast Australian herbarium, which he has generously transmitted to this country for Mr. Bentham's examination, this monumental labour could never have been brought to its present satisfactory degree of completeness.

In the concluding preface it is interesting to find that Mr. Bentham thinks that a detailed examination only confirms the general conclusions arrived at by Sir Joseph Hooker in his well-known essay prefixed to the 'Flora Tasmania' eighteen years before.* The dominant features of Australian vegetation are familiar to everybody. And we are the more struck with them because even unobservant persons cannot fail to grasp the fact that they are totally unlike the vegetable productions of any other country. Nowhere else do we meet with the dreary-looking gum-trees (*Eucalyptus*), which form three-fourths of the forests, the strange grass gum-trees (*Xanthorrhæa*), blackened, but not killed, by the bush-fires, or the stiff Proteaceous types (*Banksia*, *Hakea*, *Grevillea*, *Dryandra*), the acacias with vertical leaf-like phyllodes, the

* Bentham, 'Flora of Australia,' vol. vii., p. v.

Epacrideæ, and the beautiful genera of *Diosmeæ* which adorn our greenhouses.* Traced more into detail by the professed botanist, the strangeness and isolation of the flora makes itself more and more manifest. As, according to our present views, this could only have been attained by an enormous amount of obliteration and destruction in connecting links, which in trees implies the operation of great changes in physical conditions, determining migration and remigration and the isolation and dying out of types of vegetation about which we shall probably never be able to do more than guess, we are forced to the admission that the Australian flora is one of great antiquity. There is good ground for believing that it has existed much as we now know it all through the Tertiary epoch. Sir Joseph Hooker has remarked that the conclusion that, before some tertiary submergence of a great part of the continent, even in point of specific differences, the flora was not very different from what it now is, "would appear from a fact insisted on by Mr. Jukes, that it was during such a submergence that those volcanoes were active, the lavas of which now cover large tracts of Southern Australia, and which we know to have buried a plant identical with *Banksia ericifolia*, which is still one of the commonest trees in that part of the country." †

Plausible arguments may even be urged for the belief that the existing Australian flora is as old, at least, as the Cretaceous period of Europe. And I do not think that, on weighing all the evidence, the suggestion will be found unworthy of consideration, that the primitive stock of the Australian flora, as well as of the fauna, may have originated in the Northern Hemisphere, if not in Europe ‡ itself. Australia may be regarded, then, as a centre of preservation rather than as a centre of origin for a vegetation of an extremely ancient type (although now doubtless much modified), which in other parts of the world has given way before more modern and more powerful forms. At any rate, whatever direction our speculations take, the Australian flora seems to give little support to those who, like Grisebach, ignore the influence of geological change and explain plant-distribution exclusively from the phe-

* Hooker, 'On the Flora of Australia,' p. cii.

† 'On the Flora of Australia,' p. ci.

‡ This idea had also occurred to Sir Joseph Hooker ('On the Flora of Australia,' p. cii.), who suggests that such a southward migration would explain the existence of South Australian genera on Kini Balou, in Borneo, beneath the equator. He had, however, also in view Unger's identification of Proteaceous plants in the Cretaceous and Miocene rocks of Europe, which I agree with Mr. Bentham ('Presidential Address to the Linnean Society,' 1870, pp. 12-17) in thinking without adequate basis. In fact at *that* period European vegetation was probably of an entirely different type.

nomena of climate. If this alone has made Australian plants what they are, why do we find nothing resembling them in California, in Northern Africa, or North-west India, for the present physical conditions of which they prove to be singularly fitted.

To the Australian region, in a large sense, must be referred the vegetation of a number of adjacent islands. That of New Guinea is scarcely known. The few scanty data, however, we possess from the collection of Beccari, show that the characteristic Malayan forms so splendidly developed in Borneo, such as the *Dipterocarpeæ*, have all but died out, while such markedly Australian types as *Euparideæ*, make their appearance.* We may conclude therefore that, as was no doubt to be expected, the vegetation of New Guinea will prove to be Australian in essential features when more adequately examined.†

A most important and interesting field of phytographic investigation is to be found in the Pacific Islands east of Australia and New Guinea. A curious parallel to the zoological boundary found by Mr. Wallace to pass between the nearly adjacent islands of Borneo and Celebes (but which for plants must be drawn to the east of the latter island), exists in the marked differences between the vegetation of the chain of islands extending from the Solomon Islands to New Zealand, and that of the archipelago to the east of it. Of all these latter the flora is essentially Oriental, with scarcely an Australian type.‡ Of the former, it is equally characteristically Australian. There are, however, many anomalous details which are in the highest degree perplexing. Thus, while the large majority of New Zealand genera are represented in Australia, and quite a quarter of them nowhere else, the most conspicuous elements in Australian vegetation are wanting in New Zealand altogether. It has no *Eucalyptus*, *Acacia*, *Casuarina* or any of the great Australian genera of *Proteaceæ*. It is inconceivable that New Zealand can ever have possessed this assemblage of types, and have afterwards lost them. We are driven, therefore, to some such conclusion as that a segregation of the Australian flora must have taken place, and that, while the tropical and warm temperate typical Australian types found a centre of preservation in one or more of the large islands into which the continent is known to have been broken up, a remnant of the flora, capable of adapting itself to cooler climatic conditions, blended to the south with the Antarctic

* I have discussed this point in the 'Journal of Botany,' 1878, pp. 98-100.

† The birds, snakes and insects of New Guinea exhibit, like the plants, an infusion of Oriental types. See Wallace, 'Geographical Distribution of Animals,' vol. i. p. 415.

‡ See Hooker, 'On the Flora of Australia,' p. lxxxvi.

flora. The latter so recruited then became the common source from which subsequently, on different meridians, South Australia, New Zealand, and as we shall see, extra-tropical South America, were partly stocked.

A similar problem is presented by the presence in Australia of an element belonging to the Indian flora. Mr. Benthams finds that "a number of genera whose main station is in tropical Asia, extend more or less into tropical and eastern sub-tropical Australia, sometimes in identical, sometimes in more or less differentiated species."* This Indian element Sir Joseph Hooker regards as botanically more foreign to the Australian flora than the Antarctic element already referred to. In fact, the absence of reciprocity of distribution is still more strongly marked than in the case of New Zealand—not one characteristic Australian genus ever having been found in the peninsula of India. This again seems to only admit of explanation by supposing that the source of the Indian colonisation was an island which was first connected with the Asiatic continent, and so stocked with members of the Indian flora, but was dis severed previous to union with perhaps some extension of Australia. In this way, if such an explanation is not rejected as too hypothetical, we may conceive that an island may play the part of a carrier bringing gifts and yet taking away nothing in return.

2. The *South African* flora, as will be abundantly evident from what has preceded, is one of a very highly specialised type. Mr. Benthams remarks that "it is perhaps the richest known in proportion to its extent, and remarkably varied within its narrow limits."† Its affinities with the Australian, which do not extend beyond groups of the highest order, have been already described.

Two remarkable extensions of the South African Flora exist northwards, and are worthy of careful study. In the west of Europe and Northern Africa, there are a peculiar assemblage of plants—shrubby *Leguminosae*, species of *Erica*, *Lobelia*, and *Gladiolus*—which Mr. Benthams finds "more nearly allied to corresponding Cape species than they are to each other." The other extension is to Eastern Africa. The sub-Alpine vegetation of Kilima Njaro is distinctly South African, and the presence of some species of *Erica* in Natal fits in well with Sir Joseph Hooker's suggestion, that the South African flora has been once continued along the high lands of East Africa, from Natal to Abyssinia. The identity of the South African plants found on the Cameroons with Abyssinian species

* Benthams, 'Flora of Australia,' vol. vii., p. vi. Hooker, 'On the Flora of Australia,' pp. xvi., xli., civ.

† 'Presidential Address to the Linnean Society,' 1869, p. 25.

also suggests that Abyssinia may have been the source from which they were derived, and botanists will eagerly look forward to the time when materials will be available for studying the distribution of plants between these two extreme points of a diameter of the great continent.

3. The *Temperate South-American* flora is continuous northwards with the Andine flora. Many of its characteristic genera extend therefore as Alpines almost to the gulf of Mexico. Westward they are distributed to New Zealand, one-eighth of whose flora belongs to genera represented in and often characteristic of South America, as for example the familiar garden types, *Fuchsia* and *Calceolaria*. Besides these there are some curious if remote points of affinity with South Africa. South America is the head-quarters of a peculiar tribe of *Compositæ*, the *Mutisiaceæ*, and South Africa has more of these than any other Old World region.* Mr. Bentham and Dr. Asa Gray have also laid stress on the points of relationship between the extra-tropical North and South American floras, but taking the recently published 'Botany of California' as a basis of comparison, there are far more southern extensions of genera whose head-quarters are north of the Equator than of southern genera northwards. The most extraordinary cases are those of a few small genera which are represented by single species in Mexico, South America, and South Africa respectively. Amongst these are *Menodora*, and the Scrophularineous genera, *Melasma* and *Alectra*.†

* Bentham, 'Journal of the Linnean Society,' vol. xiii., pp. 501-502, 548.

† See Bentham, 'Presidential Address to the Linnean Society,' 1869, p. 25; and Asa Gray's 'Darwiniana,' pp. 218, 219. In an article on "Distribution," in the 'Encyclopædia Britannica,' I have, perhaps, attributed to the passages just cited more than they were intended to carry, and have included a Mexico-Californian flora amongst the sub-divisions of the great southern flora. I have pointed out above some of the striking deficiencies in the flora of south-western as compared with that of north-eastern extra-tropical North America, but the affinities of the former with that of extra-tropical South America appear to me to break down on detailed examination. The two floras appear to me essentially distinct, but to have sent out extensions across the tropics—doubtless during the glacial period—the migration from the north having in the New World, as in the Old, predominated over that from the south. I have taken from the Botany of California the following cases of the preponderating southern extension:—*Larrea*: *Prosopis juliflora*, California, Mexico, along Andes to Chili. Buenos Ayres; amongst *Onagraceæ*, *Guyophytum* (*Eurothera*), *Godetia*, *Boissierialia*, *Mentzelia*; *Cornus*, represented by a single species in Peru; *Grindelia*; *Psilacarpus*; *Madia*; *Bahia*; *Blennosperma*; *Microseris*; *Downingia*; *Collomia*; *Gilia*; *Phacelia*; *Coldenia*; *Heliotropium*—the garden Heliotrope is *H. peruvianum*; *Eritrichium*; *Mimulus*; *Orthocarpus*; *Micromeris*. Of the northern extension the genera are very few:—*Legna triphita* occurs in Chili and California, where it represents a genus with about thirty species in Chili and Peru; *Baccharis*, a characteristic South American genus, has seven species in California; *Soliva*; *Perezia*; *Petunia parviflora* extends to California; *Sphacel*; *Lippia*. The volume which has been published does not enable me to carry the comparison beyond *Gamopetalæ*. Mr. Bentham's statistics as to *Compositæ* take a wider area than California, but point

4. The *Antarctic-alpine* flora may be appropriately considered after the South American, with which its affinities are now known to be clearer since the examination of the materials collected by the Challenger and Transit-of-Venus Expeditions. Its history must, however, be to a great extent matter of speculation, and upon a somewhat slender basis. Unlike the Arctic flora, its scattered distribution over numerous isolated points of land, remote from great continental areas, from which during migrations like those attending the glacial period in the northern hemisphere, it could have been recruited, at once accounts for its limited number of species and their contracted range in the world. On the whole, it consists of local species of some widely distributed northern genera, such as *Carex*, *Poa*, *Ranunculus*, &c., with Alpine types of strictly south temperate genera characteristic of the separate localities. The following general results are derived from Sir Joseph Hooker's recently published 'Botany of Kerguelen Island.' Starting from Fuegia, the first land met with to the east is the Falkland Island Group; of this the vegetation is exclusively Fuegian. South Georgia succeeds, and the scanty botanical information recorded in Cook's voyage indicates that its plants are of the same type. Marion Island and the Crozets have a flora nearly identical with that of Kerguelen Island, distant 1650 and 1200 miles respectively. Mr. Moseley thinks that the occurrence of *Pringlea* in all three* points to an ancient land connection between them. Kerguelen Island has five species common to Fuegia and six to America, as well as New Zealand. *Lyallia Kerguelensis* is allied to the andine *Pycnophyllum*, while *Acena* is the Antarctic representative of a genus having its headquarters in Chili and solitary northern representatives in California and the Sandwich Islands. *Cotula plumosa* is common to Lord Auckland's group and Campbell's Island, and *Uncinia compacta* is found on the mountains of Tasmania and New Zealand. The remaining southern islands have a South African element; in the case of Tristan d'Acunha, Nightingale, and Inaccessible Islands, superimposed on a Fuegian basis; in Amsterdam and St. Paul's, combined with Kerguelen Island species.

III. THE TROPICAL FLORA. — Notwithstanding the considerable

to the same conclusion (see 'Journal of the Linnean Society,' vol. xiii., p. 528). The flora of Central America is most imperfectly known, and the enumeration of the species, as represented in the Kew herbarium, which Mr. Hemsley is preparing for Messrs. Godman and Salvin, will be extremely useful in relation to phytogeographical questions. The materials, however, from the southern half of this area appear to be most scanty.

* 'Journal of the Linnean Society,' vol. xv., p. 485.

collections in our herbaria, no adequate examination of the flora of any one tropical country has yet been completed; and the areas of tropical vegetation still to be explored are very considerable. The immense "Flora Brasiliensis" projected by Martius is still unfinished. Little is known of the botany of Central America and the Isthmus of Panama and much remains to be done in that of the Northern States of South America, and on the eastern slopes of the Andes; amongst the West Indies, the flora of San Domingo is a sealed book. Turning to the Old World, the collections of Kirk, Grant, Cameron, and Schweinfurth, only serve to show how vast is the work still to be accomplished before any adequate account can be given of the vegetation of tropical Africa. While we may hope in the course of a few years to see the flora of British India gradually completed, little is known at present of the eastern portion of the great botanical region which includes India to the west. As will be shown, our knowledge of the vegetation of China is most slender, while that of the countries lying between Burma and Cochin China is still more so. In the Malayan Archipelago the collections of Beccari have thrown a flood of light upon the vegetation of Borneo, but the islands to the east of it are still practically unexplored.

The difficulties in the way of arriving at any but the widest general conclusions with regard to the origin and distribution of tropical vegetation are at present very great. Comparing that of Asia and America for example, we have the authority of Mr. Bentham for stating that "the resemblance between them is only in some of the races of a higher grade, natural orders and comprehensive genera; the smaller genera and species, and many even of the higher ones, are totally different."* The presence, however, in the tropical regions of the Old and New Worlds of such well marked types as *Guttifere*, which do not extend into the temperate flora of either, can only be naturally accounted for by assuming that at some remote period the tropical flora had a common centre of distribution. If the distribution of land and water bore then—as we seem justified in supposing—some resemblance to that now existing, the transverse connection between the different branches of the tropical flora must have taken place in the northern hemisphere, and tropical vegetation must have extended—as there is reason for believing it did in the early part of the tertiary period—to much higher northern latitudes than at present. Mr. Darwin has even suggested that the present tropical flora is the blended and reduced residue of two sub-tropical floras which occupy the

* 'Presidential Address to the Linnean Society,' 1869, p. 24.

place of a more ancient equatorial flora now obliterated and destroyed.*

But though the occurrence of common tropical types throughout the tropical zone implies a common origin for its vegetation, the large amount of differentiation which these types have generally undergone in widely separated areas, show that the common starting-point must be referred to a very distant past. For example, no group of plants is more characteristic of the tropics than palms, and no better one could be selected to test this point. Dr. O. Drude finds that there is no species or genus common to the Old and New Worlds, and that the tribes are almost as distinctly limited, only two out of ten being found in both. The general conclusions drawn by Mr. Bentham from his exhaustive study of *Compositæ* (an order including not far short of 10,000 existing species), points to much the same conclusions.†

Three great divisions of the tropical flora correspond respectively to the three great continents.

1. The *Asiatic Tropical Flora* includes the Indian and great part of the Chinese empires, with the southern part of Japan and the Malayan Archipelago (but probably excluding New Guinea). It occupies also Polynesia to the north and east of the chain of islands which, as already remarked, belong to the flora of Australia.

For the general affinities of the Indian flora reference must be made to Hooker and Thomson's Introduction to the 'Flora Indica.' The materials for its detailed investigation are now ample, and considerable progress has been made in working them out. Only a few points need be touched upon here. There is a marked difference between the vegetation of the greater part of the peninsula of Hindostan and that of the areas to the north and north-east of it. The latter belongs to the type characteristic of the Malayan region, which is also represented on the Malabar coast and in Ceylon. The former has distinct African affinities, which are not merely shown by the eastward extension to India through Southern Arabia and Persia of African desert plants, but by many points of resemblance between the floras of Southern India and tropical Africa, even reaching to such negative agreements as the absence of oaks and pines in both.

Some light is thrown upon these facts of distribution by a consideration of the probable geological history of India in the Tertiary epoch. During the Eocene period Hindostan formed an island which

* 'Origin of Species,' fourth edition, p. 417.

† 'Journal of the Linnean Society,' vol. xiii., p. 391.

was separated from the rest of Asia by a sea which extended westward into Europe. Along the northern shore of this sea the Indo-Malayan flora flourished, extending northward as far as lat. 55°. There seems reason for believing that the oleander is in Europe a surviving type of it, and the genus, with others long extinct in the west probably still holds in Asia much of the ground that it occupied then, though the bottom of the nummulitic sea has long since been elevated into land. In order to explain the presence of Indo-Malayan types in Malabar and Ceylon, we may adopt the explanation which Mr. Wallace has proposed for zoological purposes, "If the shallow northern part of the Bay of Bengal had been elevated during the late Miocene or Pliocene epochs, a few Malayan types may have migrated to the peninsula of India, and have been preserved only in Ceylon and the Nilgherries, where the climate still retains somewhat of its equatorial character."* At the same time the desert plants probably entered the peninsula from the north-west.

A single fact will suffice as an example to illustrate the Asiatic character of the Polynesian flora. Casinair de Candolle finds that all the species of *Meliaceæ* included in it belong, with one exception, to genera represented in one or other of the Indian peninsulas.†

To no part of the map of Asia does the eye of the botanist wander with greater interest than to the vast territory occupied in its south-eastern portion by the Chinese Empire. The characteristic policy of jealousy and exclusion rigorously maintained towards the world outside, and which has so long at once stimulated and balked our curiosity about the economy and productions of this wonderful country, has left us in profound ignorance as to its indigenous vegetation. The paucity of our data for forming any generalisation about the place of China in any scheme of plant-distribution is almost incredible. Grisebach remarks that the whole of the interior of China, Corea, the island of Formosa, and Southern Mantchuria remain, from a botanical point of view, almost completely unexplored.‡ Dr. Hance, our invaluable correspondent at Whampoa, who never loses a chance of adding to his knowledge of Chinese plants, insists upon this no less strongly. "Whilst M. Maximowicz's excellent and very complete '*Index Floræ Pekinensis*' provides a good catalogue of the flora of the Chinese metropolis and

* 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 519.

† 'Transactions of the Linnean Society,' new series, vol. i., p. 235.

‡ Grisebach, '*La Végétation du Globe*,' vol. i., pp. 714, 715. See also Bentham, 'Presidential Address to the Linnean Society,' 1862, p. 14.

its vicinity, and Mr. Bentham's classical 'Flora Hongkongensis' has acquainted us with the principal constituents of that of the extreme south-east of the empire, nothing whatever of a scientific character has as yet, to my knowledge, been written on the vegetation of the districts intermediate to these two points, which are separated by 17 degrees of latitude, or of the various ports of trade along the coast or on the Yangtse." *

These being the only two points of detailed attack to which the Chinese flora was accessible, it must be regarded as a happy accident which determined their position. The careful investigation of the flora of Hong Kong before the island had become materially modified by its gradual conversion into a great trading centre, has proved of inestimable value in a scientific point of view. Separated from the mainland by a shallow strait, only half a mile in width, nothing would seem to justify the supposition that its vegetation can ever have been materially different to that of contiguous parts of Southern China. Yet a superficial comparison of its vegetation with that at present existing on the mainland would lead to the belief that it abounded in endemic species found nowhere else, and that its flora was of a wholly exceptional character. But the exigencies of a teeming population have long since all but denuded Southern China of its arboreous vegetation, and with the forests have gone a host of other plants which common experience in every country prove to disappear when the physical conditions change with the disappearance of the trees. Dr. Hance tells us: "A mile or two outside Canton, hundreds of plants of *Liquidambar formosana*, only a foot or two high, are met with, which prove on examination to be merely shoots springing up from old stumps buried beneath the soil, showing that this tree, now all but exterminated, was once common; and so eager is the search for firewood, that any shrub which has attained half an inch in diameter is almost certain to be ruthlessly cut down. This denudation of arboreous vegetation and consequent deprivation of shade and diminution of humidity, entail the disappearance of numbers of herbaceous plants, and will serve to explain why one-seventh of the entire number of species in the Hong Kong flora have not been met with on the adjacent continent, the sparse fishing population of the island, engaging in agriculture so far only as was necessary to supply their own wants, having left the virgin forest inviolate." † There can be no doubt that the numerous small scattered islands along the Chinese coast N. E. of Hong Kong, would yield a rich harvest to any one who

* 'Journal of Botany,' 1874, p. 258.

† Ibid., 1870, pp. 274, 275.

would take the trouble to make even small collections in any of them to which circumstances or accident afforded access.

Of late years the obstacles in the way of penetrating and collecting in the interior of the empire seem to have materially diminished; and Kew is indebted to several energetic European residents for collections, though small in extent, of the highest interest and value. In fact I know of no field for botanical exploration where amateurs could at the present time collect with less trouble and with more probability of rendering useful aid to science than in China. Dr. Hance remarks: "Every short excursion from Canton or other cities where foreigners reside, leads to the discovery of three or four new plants."* It is quite remarkable indeed how little advantage has been hitherto taken even of the opportunities that were available. I quote the following case in point from one of Dr. Hance's papers:—"The temple where I slept is only six miles outside the walls of Canton, and is often visited by pic-nic parties; and yet, though the small wood surrounding it has plenty of *Quercus fissa*, Champ., some *Castanopsis chinensis*, mihi, and two trees of *Liquidambar formosana*, mihi, about 80 feet high, none of these species were known a few years ago; and a new *Pygeum*, together with [my *P. pheostictum* are to this day undescribed."† These small woods, it is interesting to observe, have served botanically the same function as the scantily peopled islands of the coast. Chinese "temples," Dr. Hance tells us, "are for the most part built in depressions or glens between the converging apices of spurs, in order to defend them from the violence of the wind; and are further sheltered on the sides and at the back by thick woods, the constituents of which, so different from the trees habitually planted by the Chinese for ornament or shade, unequivocally prove them to be the remnants of the once wide-spreading forest, preserved from destruction only by the presence of the sacred edifices which they embosom."‡

I mention these details, interesting however in themselves, more particularly since I feel satisfied that it must be in the power of many Fellows of this great Society to interest friends resident in China in the work of collecting. And if anything were needed in addition to what I have already said to show how useful even small contributions may be, I may point to our obligation to Dr. Shearer for a collection from Kiu Kiang, the novelties in which have been described by Mr. Baker and Mr. Le Marchant Moore,§ and which

* 'Journal of Botany,' 1878, p. 6.

† 'Journal of the Linnean Society,' xi., p. 455.

‡ 'Journal of Botany,' 1870, p. 275. § Ibid., 1875. pp. 199-202, 225-231.

included a new Tulip-tree (*Liriodendron*), hitherto regarded as an exclusively characteristic feature in the North American flora; to Mr. Forbes, of Shanghai, who is devoting himself especially to the task of working out the Chinese flora; to Mr. Ross, who has sent us valuable collections from the neighbourhood of Newchwang; and lastly, to Dr. Hance, to whom I have already referred.

From what has been said, it is easy to agree with Grisebach, that we can only guess at the richness of the Chinese flora. Our present data point to its close relationship with that of Japan, and the presence in it of a strong admixture of Northern Indian and Himalayan types.* This latter relationship would doubtless appear more closely if there were any present means of examining the flora of North-West China and that of the mountainous country north of the Mishmi Hills. The cultivated tea-plant of China is no doubt specifically identical with that found wild in Assam. Still they are distinguishable in general appearance, and I am not aware that the wild progenitor of the Chinese tea-plant, which probably differs as a geographical form from that of Assam, is to be found in our herbaria. But there can be no kind of doubt that it must exist in North-Western China, and its presence is a highly characteristic indication of the continuity of its flora with that of North-Eastern India. Farther south the flora of Yunan, as far as it could be investigated from the collections formed by Dr. J. Anderson, repeats on a lower parallel the eastward extension of the Indian flora. Kurz found that the species were decidedly Khasyan, and for the most part well-known.† The results of the interesting journeys of Lieutenant-Colonel Prejevalsky fall in with this hypothesis of a general eastern extension of the North Indian flora. He found the wooded mountains of Kansu east of the Koko-nor ablaze with red, white, and lilac rhododendra, and collected *Rheum spiciforme*, which is a Himalayan plant.‡ All students of geographical botany will look forward with eager interest to the publication of the full details of Prejevalsky's collections, consisting of 5000 specimens, representing 500 species, of which a fifth are said to be new. No less valuable would be the results of Père David's collections, which doubtless contain examples of the sixteen kinds of rhododendrons found by him on the mountains south-east of the Koko-nor.§

Other elements in the Chinese flora will, no doubt, also, as it becomes better known, make themselves evident. Towards the east it passes imperceptibly into the temperate North Asiatic flora.

* See Hance, 'Journal of Botany,' 1870, pp. 275-276; 1874, p. 258; 1878, p. 8. Le Marchant Moore, *l. c.*, 1875, p. 231.

† 'Journal of Botany,' 1873, p. 193.

‡ 'Mongolia,' vol. ii. pp. 85-87.

§ Prejevalsky, *l. c.*, vol. i., p. xxxii.

In fact, Prejevalsky found almost a Siberian vegetation along the frontier as far as Kansu.* On the other hand, the vegetation of Southern China will no doubt be found to be largely intermingled with Indo-Malayan types. Dr. Hance remarks that the grasses have a close affinity to those of Ceylon.† He has also noted the extension to China of some types belonging to Northern and Eastern Australia.‡

2. The *American* tropical flora is still, as already remarked, too little worked out to allow of even approximate analysis. Mr. Wallace deduces from zoological evidence the isolation of South America through almost the whole of the Tertiary period, union with the northern continent having, however, taken place once at least in Secondary or early Eocene times.§ This agrees on the whole with the botanical facts. Mr. Bentham's comparison of the *Composite* of the tropical regions of the Old and New World lead him to the belief that no mere migration of American types will explain the points of agreement, but that this element in the vegetation of both must have had a remote but common source of origin,|| followed by great local differentiation and extinction. It seems to me that the facts of the case would be met by supposing, as I have already done, that the transverse intercommunication which they imply took place in the northern hemisphere. In this way would be explained also the presence in the American and Asiatic flora of the same genera of such a typically tropical order as *Ternstroemiaceae*. Out of thirty-two genera as many as five—viz., *Ternstroemia*, *Cleyera*, *Saurauja*, *Archytia*, and *Laplacea*, are represented in the Indo-Malayan and South American floras. *Gordonia* is a *Ternstroemiaceous* genus, which in the New World has lagged behind, being represented in North America only with two species, and in the Indo-Malayan flora by about eight.

The eastward extension of the Indian vegetation through Polynesia affords a tempting hypothesis that this may have been the path by which Indo-Malayan types found their way across. The results of Casimir De Candolle's investigation of the distribution of the *Meliaceae* seem, however, to me to tell all the other way. Not a single American genus or species extends to the west of the Peruvian or Columbian Andes, while none of the Asiatic forms get farther west than the Navigators' Islands. On the other hand, the distinct

* Prejevalsky, *l. c.*, vol. i., pp. 160-163.

† 'Journal of Botany,' 1878, p. 8.

‡ *Ibid.*, 1876, p. 14.

§ 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 532.

|| 'Journal of the Linnean Society,' vol. xiii., p. 492.

Polynesian and American forms find their connecting links in the Asiatic region, from which they, according to my view, have diverged eastward, north and south of the Equator. The northern contingent has scarcely left a surviving trace north of the tropic, though we may fairly explain in this way the two outlying species *Cedrela sinensis* and *Aglaia odorata*, which are found in the neighbourhood of Pekin.

3. The *African* tropical flora undoubtedly affords indications even in the present fragmentary state of our knowledge about it, of the existence of very difficult problems in the study of its plant-geography. Mr. Bentham's extensive investigations have led him to the belief, more than once expressed, in the great antiquity of the vegetation. "Here, more perhaps than in any other part of the globe, in *Composite* as in so many other orders, we may fancy we see the scattered remains of ancient races dwindling down to their last representatives."*

Two elements in the flora at once challenge investigation. Both American and Asiatic types are represented in a way which points to causes more fundamental than the casual intermixture brought about by the various agencies of plant migration, ordinarily adduced to account for the isolated existence of species far away from their head-quarters. We may explain by them the occurrence of identical species on the shores of the opposite continents separated by the Atlantic, such as *Entala* and *Gyrocarpus*, and *Carapa procera* on the West Coast of Africa and in the Guianas. But there appear to be in the interior of the continent American types the presence of which it is difficult to attribute to agencies now acting and which we must therefore refer back to the common origin or transverse connection of the floras now so widely divided. It may perhaps prove to be the case that the American and Asiatic types in Africa will find a common interpretation, and that as Mr. Bentham seems inclined to think, the American element above referred to came from the east rather than from the west.

A few instances may be given which seem not inconsistent with this explanation. Thus *Schmidelia* has its head-quarters in tropical America, but is also represented in tropical Asia, whence it has found its way to Africa on the one hand, and the Malayan Archipelago and Australia on the other. *Mammea* again, with one well-known species in tropical America, reappears in tropical Asia, Madagascar and Africa. *Trichilia*, however, is represented in tropical America and Africa but not in Asia. Identical species

* 'Journal of the Linnean Society,' vol. xiii., p. 492.

are even widely distributed in the tropical regions of the Old World. Thus *Asparagus racemosus* and *Chlorophytum laxum* are common to Africa, Asia, and Australia, while the beautiful *Gloriosa superba* is found in central Africa and also in the Himalayas. Finally the curious Baobab (*Adansonia*) exists as two species, one African and Asiatic, the other Australian.

The affinity of the flora of Madagascar with that of Africa is well marked; but there occur in it undoubted Indo-Malayan types which also connect its flora with that of the Mascarene Islands. *Nepenthes* is a striking example; finding its head-quarters in the Malayan Archipelago, it is represented in Khasia, Ceylon, the Seychelles and Madagascar. *Dipterocarpeæ*, a very characteristic Indo-Malayan family, extends westward to Africa; Ceylon is rich in species belonging to it, and one is also found in the Seychelles. An explanation of this gradual creeping westward of Malayan vegetation has already been partially given, and the connection with Africa which would account for the presence of some African types in Southern India and the extension of Malayan and even American types to Africa, may perhaps be explained by supposing with Mr. Wallace that the scattered islands in the Western Indian Ocean are the remains of a once larger land surface which acted as an intermediate resting-place for the interchange of Asiatic and African plants as well as animals.

I must now attempt to sum up the general conclusions to which I have been led in the brief survey—of which I cannot but confess the extreme imperfection—of the present state of the subject. I find myself driven to the opinion that the northern hemisphere has always played the most important part in the evolution and distribution of new vegetable types, or in other words, that a greater number of plants “have migrated from the north to the south than in a reversed direction.” At any rate all the great assemblages of plants which we call floras seem to admit of being traced back at some time in their history to the northern hemisphere.* It is easy on this supposition to account for their possession of common characters which, in their widely scattered southern distribution, is not readily explained on other grounds.

In the Carboniferous period the maximum of vegetation existed apparently in the northern hemisphere, and characteristic plants

* Mr. Wallace regards the northern hemisphere in respect to Mammalia “as the birth-place of the class and probably of all the orders.” ‘Geographical Distribution of Animals,’ vol. ii., p. 544.

of this age are found in Brazil * on the one hand, and Australia † on the other.

In the Oolitic period we have undoubted evidence of the existence in Europe of types such as *Cycadeæ*, *Araucaria*, and *Pandaneæ*, which are now either confined to or dominant in the southern hemisphere. The present distribution of *Cycadeæ* is exactly what might be expected, supposing different branches of the family to have gradually travelled along different continents from north to south. In Australia, Africa, and America the genera are different. Australia has *Macrozamia* and *Bowenia*; Africa has *Encephalartos* and *Stangeria*; America has *Zamia*, *Ceratozamia*, and *Dion*. *Cycas* follows the fortunes of the Indo-Malayan flora, and occurs over an area reaching from Japan and the Himalayas in the north to Queensland and the Comoro Islands in the south. This is the only genus common to two continents—a state of things which would hardly have happened if there had been land connections to the south between them subsequent to the arrival of *Cycadeæ*. Cycads are not plants whose structure lends itself to aerial or oceanic dispersion, and to the complete isolation of the different branches of the family may be attributed the existing differentiation of the genera. The present distribution of *Araucaria* may have been brought about in the same way. The two sections of the genus are both represented in Australia and the adjacent islands, but the species peculiar to South America belong to only one of these, and it may of course be argued that they have been derived from Australia. In any case, however, they are survivors in widely-scattered portions of the world of the ancient Jurassic flora. It is worth while observing that rocks of this age in India have yielded fossil forms closely agreeing with those found in the Lower Oolites of Yorkshire (*Williamsonia* ‡), and the fissile limestone of Stonesfield and Solenhofen (*Araucaria*, *Thuites expansus*).§ Uniformity of vegetation at such great distances indicates a greater uniformity of climate than at present exists, and this would favour the dispersion of the flowering plants, which, at any rate in Europe, made their appearance in the Cretaceous age, side by side with the waning Jurassic flora. The identification of Cretaceous plants with *genera now existing* in South Africa and Australia, appears to me, however, to be doubly

* Plant and Carruthers, 'Geological Magazine,' 1869.

† Clarke, 'Journal of the Geological Society of London,' vol. iv., p. 60.

‡ 'Memoirs of the Geological Survey of India,' ser. ii., 3, p. 19.

§ *l. c.*, ser. xi., 2, pp. 16, 17. *Eckinostrobus rhombicus*, Pl. xi., figs. C-11, seems to me identical with *Athrostaxis lycopodioides*, another Australian type, which I have discussed in the 'Geological Magazine,' 1872.

doubtful after the criticism of Mr. Bentham, and as anticipating the appearance of forms which it may be assumed with probability were only differentiated in the southern hemisphere.

But it seems to me that to this age we must look for the dispersion of the ancient flora whose remains, as I have already pointed out, are scattered over the southern hemisphere, and which, according to my view, have descended southwards along different meridians, rather than have been distributed from some great southern continent. I am quite aware that this suggestion is attended with considerable difficulties. Mr. Bentham, in studying the *Campanulaceæ*, thinks that the evidence points to a southern origin for one of the tribe (*Lobelieæ*), and a northern for the other (*Campanuleæ*)*. The existence of identical genera sections and even *species* of this order in South Africa and Australia leads to the suggestion that they may be specially adapted to avail themselves of means of dispersion, and that they are a more modern element in the two floras than the general substratum, whose points of affinity are only now to be found in groups of a much higher order than genera and species.

In the Eocene period following the Cretaceous, we appear to have evidence that the marked differentiation between temperate and tropical vegetation had been already reached, and the wider extension of the latter into the northern hemisphere in modern times would appear to me to allow of the affinities which exist in the three great tropical floras, excepting those which are the result of intercommunication in later Tertiary times.

As the tropical flora gradually settled down into its own area the Miocene vegetation took possession of the present temperate zone of the northern hemisphere, having its origin chiefly perhaps in the New World. The differentiations then gradually arose which furnished the Mediterranean and Mexican regions with their characteristic floras.

The Glacial period followed in due course, and made enormous changes. The Miocene vegetation was swept out of North-West Europe and South-Western North America, and the forms which the temperate flora assumes under extreme conditions of low temperature were widely distributed even to countries south of the equator. A corresponding, but quite subsidiary, migration northward of southern forms took place at the same time. Mr. Darwin explains the wider extension of northern forms on principles which I am inclined to think applicable, as I have attempted to show,

* 'Journal of the Linnean Society,' vol. xv., p. 9.

to ages long antecedent to the Glacial period. "I suspect," he remarks, "that this preponderant migration from the north to the south is due to the greater extent of land in the north, and to the northern forms having existed in their own homes in greater numbers, and having consequently been advanced through natural selection and competition to a higher stage of perfection or dominating power than the southern forms."*

It only remains to consider how far the results arrived at in the preceding pages agree with the facts of animal distribution. I believe that they will be found to do so better than a mere comparison of the botanical regions which I have indicated with those proposed for animals by Mr. Selater would lead us to suppose. Animals are far more independent of latitude than plants. Even in the case of insects, which are so closely dependent on the latter, Mr. McLachlan has remarked that the butterflies found by the recent Arctic Expedition north of lat. 78° belong to "genera such as one might expect to meet with on a summer day's walk in England."† It is scarcely necessary to point out that as much could not be said for the vegetation. The range of the tiger, "popularly supposed to be confined to the hot jungles of India," as far north as the Island of Saghalien, in lat. 52° , on the same parallel as the south of England, but with a much more severe climate, is a still more striking case.‡

A division of the world into districts, based on the facts of animal distribution as *now* existing, will, probably, therefore, be less closely related to past geological and geographical changes than one based on plant-distribution. Thus I have shown in the previous pages that botanically the Palearctic and Nearctic divisions have not much significance, and Mr. McLachlan remarks that they cannot "be maintained for insects, except as terms of convenience."§ Again, to adopt for botanical purposes the Ethiopian and Neotropical divisions would be to entirely ignore the marked peculiarities of the southern extremities of the respective continents. Nor is it quite clear to me that they do not make matters too simple even from the zoological point of view, since "south temperate Africa," remarks Mr. Wallace,|| "still exhibits a remarkable assemblage of peculiar forms of mammalia, birds, and insects."

I need hardly say that it is with extreme diffidence that I hazard

* 'Origin of Species,' 4th edition, p. 452.

† Nares, 'Voyage to the Polar Sea,' vol. ii. p. 236.

‡ See 'Natural History Review,' 1861, p. 16.

§ 'Journal of the Linnean Society,' "Zoology," vol. xiv., p. 104.

|| 'Proceedings of the Royal Geographical Society,' vol. xxi., p. 517.

these suggestions. I shall be content if I have made it probable that the last word is far from having been said on the analysis of past geographical change in the light of the distribution of existing forms of life, and that if the study of plants leads more slowly and with less immediately brilliant results to its correct appreciation, it will in the end give us a not less accurate solution of our problems. But such an end is still a very long way off, and it will never be reached without—as I began by saying—the earnest co-operation of those who devote themselves to botanical studies and to geographical exploration.

The CHAIRMAN, in asking the Meeting to return their thanks to the lecturer for his most instructive discourse, said he felt sure that the eloquent appeal that had been made, and the cogent arguments by which it was backed up, could not fail to bear practical fruit. Mr. Thiselton-Dyer had shown them how much a traveller could do, and how little many had done, in the matter of geographical botany. Mr. Wallace had dealt with the present geographical distribution of land and sea, and the way in which it occurred, as evidenced by the animal life now found upon the earth: in the same way Mr. Thiselton-Dyer had recalled their attention to the fact that the evidence afforded by plants was at present exceedingly scanty; but when it was supplemented more fully it would give most valuable data towards determining that problem. It seemed strange that travellers did not more frequently go out prepared with the knowledge of the kind of questions that were sure to be put to them when they returned. For instance, they would be asked, "What does the country afford? What are its commercial capabilities and its economic products?" The economic products had been largely treated of in the lecture, and travellers could not do better than co-operate more closely than they had done with Kew, to obtain from there information as to what was especially wanted to be observed in the country to which they were going, so that they might make their collections with special reference to the enlargement of the valuable collection in the national herbarium. It now simply remained for him to adjourn the Meeting to November the 11th, when he hoped their recently elected President, the Earl of Dufferin, an old member of the Society, would take the Chair.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Mr. J. M. Hildebrandt on his Travels in East Africa.* From the 'Proceedings' of the Geographical Society of Berlin, vol. iv. (1877), read at the Meeting of the Society on December 8th, 1877.*

UPWARDS of three years ago I had the honour to describe at a Meeting of this Society my first Travels on the Coast of Arabia; in the border lands of Abyssinia and Egypt; in the volcanic districts of the Danakil; in Somali land; and in the territories of Zanzibar—travels which extended over the period between the beginning of the year 1872 and the month of August, 1874.

To-day it is permitted me to give you a short summary of my wanderings which I have performed since the commencement of the year 1875.

Whilst other travellers have been engaged in bold efforts to enlighten the geographical darkness of the black Continent, and whilst these, pushing on with restless activity, would not permit, as it were, the grass to grow under their feet, the task fell to me to collect this grass, and through collections and observations regarding natural history to paint in characteristic features a topographical sketch of the countries visited.

In the month of February, 1875, I arrived at Aden, and employed myself for some time in collecting and arranging anthropological information.

After engaging men and procuring articles of barter, I returned to Somali land.

In March, 1873, I penetrated from Lasgori to the Ahl Mountains, as far as the Pass of Yafir: on this last occasion I landed at Meith, in the territory of the Habr-Gir-Hajis Somalis, and advanced into the interior to the Serrat hills, in the country where frankincense and myrrh (and probably gold also) are produced.

I found the Habr-Gir-Hajis Somalis in great commotion in consequence of the Egyptians having a short time previously taken military possession of the market-towns Zeila, Tajurra, and Berbera, having also seized upon the City of Hurrur, which is situated further in the interior. The freedom and independence of the Somal, never previously threatened, were subdued by means of Bakshish and "Kurbatsch" (rhinoceros-hide whips).

The Habr-Gir-Hajis saw the enemy advancing nearer and nearer, and considered me a forerunner of the Egyptians, who, under the lambskin of a collector of plants, concealed a bloodthirsty heart.

It was not easy to convince them of my friendly disposition, so far as to obtain their permission to travel into the interior.

The great eastern Horn of Africa, on which the strong stream of the Indian Ocean breaks, and on which, in the neighbourhood of Cape Guardafui and Ras Hafoon—the Scylla and Charybdis of East Africa—so many ships have found a grave, is of Limestone formation.

Many of the ranges of mountains running parallel to the coast rise to a height of about 2000 metres. Their fantastic, broken summits, standing out in bold

* Translated by General C. P. Rigby.

relief against the deep blue of a tropical sky, possess a vegetation essentially different from that of the granitic mountains of Abyssinia. Especially are they rich in gum- and resin-producing plants.

The ancients named Cape Guardafui, or rather perhaps the entire peninsula, "Promontorium aromatum." During my exploration of these mountains, I found many species and genera of various botanical families previously unknown. So that the mysterious origin of the frankincense and myrrh is now cleared up. There also are found the wonderful "Dracænæ," or dragon-trees, which produce the dragon's-blood; and the aloë, which, however, does not here, as in the neighbouring island of Socotra, produce the bitter resin used in medicine. Here is also found the "Gekar," a tree nearly allied to the true botanical frankincense. It produces a resin which, like gum mastic, is used for chewing. It is not an article of commerce, but is sometimes brought through Egypt to Marseilles, where it is cleaned and perfumed, and then exported to Eastern harems to beautify the teeth. This resin would doubtless command a ready sale, and in its cheapness possesses the greatest virtue of commerce. This district is also rich in tanning plants. The leather garments of the Somal are as soft as linen, and a few days' tanning are sufficient to produce this result. The dry leaves of the aloë also produce a dye of deep violet colour.

We know from ancient authors that these districts, at present so desert, were formerly populous and civilised. I also discovered ancient ruins and rock-inscriptions both in pictures and characters. These have hitherto not been deciphered. But as the Mahomedan Somalis of the present day place a cross at the head of their graves, it can easily be imagined that here, as likewise in Socotra, Christian colonies were established.

The manners and customs of the Somali race are of the highest interest, and I gained sufficient insight into them to enable me to add considerably to my previous remarks upon this race, published in the *Zeitschrift für Ethnologie* (Journal of Ethnology). I believe that I have also collected all the utensils and implements used by them in their housekeeping.

I had, however, a very narrow escape from entirely losing my so painfully accumulated collections, for one day several hundred warriors assembled around me, calling for the goods and life of the hated stranger. However, the rattling of the needle-gun somewhat cooled their ardour, so that after bargaining for several hours they agreed to accept a compensation, to be paid at Kautabak, for the loss and injury they sustained by the witchcraft my visit would entail. On this opportunity I had the honour of entertaining seventy-four "sultans" who invited themselves as my guests. Although the reddest republicans, instead of styling themselves citizens, as with us, they all called themselves "sultan."

After many unsuccessful attempts to penetrate further into Somali land, I found myself obliged to return to Aden. I forwarded all my collections to Europe, and then returned to my former head-quarters at Zanzibar, where I was met on the shore by the black companions of my former travels, and accompanied to my dwelling, which was named by my friends the "Poison booth." I did not remain long in Zanzibar, and at the beginning of June, 1875, I went to Johanna, one of the Comoro Islands, in order to explore its natural history.

Although situated so near to Madagascar, and similar to the pillars of a bridge between that island and the African Continent, the settlers in the Comoro Isles are a distinct race from the people on either side, owing to the hindrances to communication caused by the great equatorial ocean stream. This flows with full force past these islands, and breaks against Cape Delgado on the mainland, and thence flows rapidly through the Mozambique Channel, removing both the Comoro Isles and Madagascar far from African influence.

Johanna is certainly one of the most beautiful islands in the world. The

Tingidyu Peak, an extinct volcano, rises in bold outline 5172 feet above the sea. The dampness of the sea breezes is condensed into almost perpetual rain on its forest-clad summit. Here the mischievous hand of man has not hitherto, as in Mauritius and Reunion, disturbed the relations between precipitation and vegetation by cutting down the forests. The trees attain an immense growth. The dense foliage covers the masses of rock. Like giant rigging stretch the creepers, as thick as one's thigh, from tree to tree, to the highest points, with beautiful orchids and many other Epiphytes displaying their bright blossoms. Like a forest beneath the forest, spread the fans of many species of rare ferns. No rough blasts destroy the beauties of these most elegant of all the vegetable kingdom, no dazzling sunbeams scorch their fresh shoots, being protected by the dense groves which cover them. The fern world is only at times agitated by light breezes, the light-green leaves harmonising with the dark-brown trunks of the giants of the forest. My botanical booty collected in the Island of Johanna may be described as very rich. It is already in part classified by approved authorities.

In common with most oceanic islands, few species of mammiferous animals are found. And few birds and insects are met with.

Considerably the greater portion of the population consists of African slaves, who are employed in the coffee and sugar plantations. The "Amatsáha" who inhabit the mountains appear to be the aborigines of the island. Like the inhabitants of Madagascar, they have not yet lost the Malay type, which is chiefly marked by the roundness of the skull, so characteristic of this race.

A vocabulary of the Chinzuani is printed in the *Journal of Ethnology*, and in the 'Journal' of our Berlin Society, *Zeitschrift d. Geo. f. Erdk.*, vol. xi., 1876, page 37 to 52) are some very original stories of animals contained in a sketch of the natural history of the island.

The small-pox having broken out in Johanna, rendered it impossible to hold any communication with the other islands of the Comoro group. In consequence, after a stay of three months, I returned in September, 1875, to Zanzibar.

My task was now to explore the snowy mountains of Eastern Africa. I engaged men, exchanged my money for articles of barter, and went by ship to Pangani. Here was equipped a caravan of 2000 men, comprising the united traders in ivory, for a journey through the Masai country to the Bahariya-pili (literally, "the second ocean"), the Victoria Nyanza of the Maps.

I was invited to join this caravan, but I declined the offer, as this route did not lead to the termination I had in view. A year later I learnt that this very caravan was attacked by the Masai, and that very few of the number escaped their deadly spears. Generally, during the last two years nearly all the ivory caravans have been destroyed by these savage hordes. They burst like a hurricane among the peaceable Negro races, destroying all who oppose their sudden rush. Cattle robbery is their chief object in these warlike undertakings. According to their savage habits, they must acquire cattle in war, with which to purchase wives.

From Pangani I went to Lamu, to endeavour to penetrate along the Tana (River Dana) into the lands of the South Galla tribes, and thus to reach Mount Kenia. But all my efforts to form a caravan were in vain. The Somalis had burst into the lands of the Galla from the north, overpowered them, stolen their cattle, and threatened in the giddiness of their victory the destruction of all strangers. At the same time news arrived at Lamu of the seizure by the Egyptians of the south Somali towns of Brava and Merka and others under the Zanzibar dominion.

The inhabitants occupied themselves in erecting fortifications, dragging out ancient cannon covered with the rust of centuries, and planting them on the beach, day and night firing their muskets in the streets, and with threatening

war-songs prepared for bloody warfare. But on a sudden all the war-songs were silenced by the appearance of an Egyptian man-of-war which cast anchor in the roadstead. Several European officers landed from her, and after a short walk re-embarked, and the vessel sailed away. No sooner was she out of sight than the brave people of Lamu commenced firing rounds in honour of victory, and uttering their wild war-cries. This nervous state of the population was in the highest degree obstructive to my plans.

From Lamu I made several trips towards the interior country, as far as the boundaries of Arab influence. I also visited the ruins of an ancient city near the mouth of the River Ozi, which is mentioned under the name of "Jaca," in an inscription in the fort of Mombassa, and which some travellers have pointed out as "Chagga" of Kilimanjaro. I everywhere met with invincible obstructions to my further progress. I was confined to my encampment by an attack of fever and scorbutic ulcers on the legs. With a heavy heart I left Lamu in December, 1875, and took ship for Mombassa, trusting to be restored to health through the aid of the doctor attached to the English Mission station, and also to ascertain the possibility of penetrating into the interior from that city.

On my arrival at Mombassa, I made inquiries regarding the state of affairs in the interior, and also employed my time in noting down and acquiring the requisite languages, and also, carried in a hammock, made several excursions in pursuit of natural history.

My health, nevertheless, got much worse, and as the doctor of the mission was obliged, by the state of his own health, to return to Europe, I found myself compelled to return to Zanzibar to obtain medical aid. After some time, in the hope that the medicines I had obtained would restore my health, I returned to Mombassa, where I had left all my people.

Lieutenant von Kalkreuth, whom I met in Zanzibar, accompanied me. He intended to go on a hunting expedition in the interior, and wished me to assist him in equipping a caravan. However, he gave up his intention, and assisted me in collecting birds, which I preserved whilst confined by illness. At length I became aware that I could not recover my health in the unhealthy climate of the coast, where Lieutenant von Kalkreuth also suffered from an attack of fever. We therefore returned to Zanzibar, and I was admitted into the hospital of the stationary English man-of-war *London*.

Most earnestly do I thank the honoured African Company for the welcome aid afforded me during my misfortunes.

The excellent nursing I received on board the *London* and the fresh sea air completely restored me to health, so that in November, 1876, I was again able to start on my travels. I only delayed a few days in the city of Zanzibar. I despatched my collections of natural history, engaged followers, and fitted out another expedition. I had gained sufficient knowledge during my travels regarding the articles of barter requisite for a journey to the snowy mountains. After my arrival at Mombassa, I first undertook a short trip to Maweni in Duruma, in order to try my own strength, and the value of my newly engaged men. Here I visited the so-called antimony mines, visited without result by former travellers. I found Potter's ore, specimens of which I sent to the Sultan of Zanzibar, and requested that they might be sent with other collections to Berlin. Through inadvertence these were detained in Zanzibar until I found them there on my final return.

It is often made a reproach to travellers that they do not sufficiently turn their attention to technical articles of produce. I have myself forwarded to the mercantile houses there, and also to the museums of Europe, several very important articles of raw produce, and have always received this reply, "We will inquire into the matter," and there the subject has dropped.

On the 10th January, 1877, I left Mombassa, accompanied by about fifty

natives, who acted both as escort and porters. It was a happy day. In front waved the white flag with inscriptions from the Koran. Friends and relations escorted the porters, relieving them of their loads, whilst the latter joyously advanced, dancing, singing, and discharging their fire-arms.

We advanced over the wonderfully fruitful undulating coast lands of the "Wanika" and "Waduruma." Plantation succeeded plantation; but most of the cattle had been plundered a short time previously by the Masai. But as soon as the land sinks towards the interior and loses the moist sea breezes in the immense plains, the scenery acquires the true African type. The dazzling red or yellow earth, baked hard by the heat, is covered with dense thickets of succulent poisonous euphorbias, interspersed with thorny and prickly foliage of various other families of plants, which make the paths difficult for both man and beast. Here and there are large umbrella-shaped trees, covering the path with their shady branches. Only at the widest intervals is water met with in this desolate wilderness. It is preserved in cavities in the rocks from the former rainfalls. At these water-holes lurk the "Ariangulo," wild bushrangers of the Galla race, to fall upon the trading caravans.

Scratched and flayed by these terrible thorn-trees, with empty stomachs and empty water-casks, for it was the height of the dry season, after six forced marches we reached "Taita," and pitched our camp at the foot of the "N'dara Mountain," in the territory of the Chief Yakuti. The difficulties which the haughty mountaineers—the Wataita—are in the habit of placing in the way of white travellers, were more easily overcome by me, as I had assumed the character of a trading Beloochi. But in my further journeys I could not expect to sustain this character, as the fable of a coming European, arising from the sea, like a Messiah, had preceded me, through the sorcerers, the prophets of the land. These regarded me as a colleague, a powerful sorcerer, who commanded the rain and the drought, life and death.

On this mountain-tower the natives, at my orders, brought me specimens of every species of plant and animal, which I of course added to my collections, and consulted as an oracle. After much opposition the Wataita permitted me to ascend the mountain, "to make medicine," with which to fructify their fields. These would be rendered more fruitful by the use of cow-dung, yet so extraordinary did this appear to them that they really followed my advice, and I had the pleasure on my later return to see them all bright with verdure.

From "N'dara" we wandered in a north-westerly direction, and arrived at the river "Voi," which, coming from Muai, a portion of the N'dara range, flows into the sea to the north of Mombassa under the name of "Tanganyiko." At this dry season the stream was only knee-deep, and about 8 metres broad. After the rainfall it overflows its low banks, and consequently they produce rich crops of sugar-cane.

I also ascended the "N'di," another mountain of Taita, and measured its altitude with my magic instruments. It is about 4600 feet in height, and 2000 above the wide plains surrounding it. In relation to natural history these tropical mountains are in the highest degree interesting. My booty was very considerable, but I was unable to remain long in Taita, as in consequence of the failure of the autumnal rains there was a famine raging. It was only at a most exorbitant price that I could obtain a very scanty supply of provisions for our eleven days' march through the uninhabited desert between Taita and Ukamba. It is owing to the camel-like nature of the Africans that they are enabled to travel, thirsty and with gnawing stomachs, along those thorny paths in a burning sun, carrying from 80 to 90 pounds (German) weight, for 8 to 10 hours daily, and withal be merry and jovial. We followed a war-path of the "Wataita" across the desert, on which, a short

time before, they had fallen on a caravan of the Wakamba. The far-reaching renown of my needle-gun fortunately preserved us from a similar fate.

On the second day we reached the "Tsavo," a river fed by the snow-water from Kilimanjaro, and consequently always containing a flow, as also the neighbouring river, the "Adi." This latter has its source on the snowy mountain "Kenia in Kikuyu," flows to Ukamba on the west, and on the south forms the boundary between "Ukamba and Taita." It falls into the Indian Ocean as the "Sabaki" near Malindi. During the rainy season the natives cannot ford it. It rises to a height of 20 to 25 feet, and overflows its banks to a great distance. At this time, in the height of the dry season, only small channels of water trickled down its sandy bed (about 150 paces broad). However, it continually provided us with a sufficient supply of water, and its friendly green banks produced Dom-palm, lottu, thickly foliated sycamores, tamarinds, and acacias. Monkeys and many species of song-birds also abounded. Wild animals of all descriptions come from afar to this point to drink. Seldom, however, are human beings met with. Only the Wakamba hunters frequent this part, to shoot elephants, rhinoceroses, and buffaloes, with their poisoned arrows. Formerly the fruitful banks of this river were cultivated by the Wakamba, but the savage Masai have destroyed everything.

I formed an intrenched camp on the banks of the "Adi," and wandered about the surrounding country making collections, and at the same time despatched people to "Kikumbulyu" to procure provisions, for, with the exception of the few fish we were able to catch, we had nothing to eat. Afterwards we forded the "Adi," and travelled N.N.W. over the chain of Ndungu Mountains to Ukamba, where we rested several days near the village of "Malumboa," in order to obtain a supply of provisions, to which a few fat sheep and goats were found a most welcome addition. We then travelled, still to the N.N.W., past the village of "Kipopotue" to the Tiva, also a branch of the Adi, and thence to Jkanga on the Ndeo, which, like the Tiva, into which it flows, rises in the desert between Kitui and the Tana. The flat bed of the Ndeo is utilised for the cultivation of sugar-cane and other plants, but, owing to the laziness and want of foresight of the inhabitants, only to a small extent.

Following the course of the Ndeo, I arrived on the 12th of March of this year, 1877, with my remaining followers (eight having deserted) at "Kitui," and formed a fortified camp, according to the most approved method of African warfare, near the village of the Chief Milu.

In Kitui I had to overcome the greatest prejudice against my person and objects, because after Dr. Krapf's unfortunate journey to the Tana, which he undertook in the year 1851 in company with the then chief, Kiwei, the latter was murdered by robbers of Kitui. The blame of this murder fell upon the missionary, who was said to practise necromancy with a black instrument (probably his pocket Bible). Now it was imperative that I, a brother European, should pay the penalty of guilt, which Krapf escaped by his flight. Like my predecessor, I was said to practise the same murderous plans, by collecting specimens of rocks, plants, and animals, to destroy the entire land. My beard, said they, was longer than that of any he-goat, my hair hung like cows' tails over my head; such an extraordinary man could only possess the most wicked intentions. If I were, nevertheless, a friend of the Wakamba, I should open my heart to them, that is, I should expose to them the contents of my bales of goods, and give them a great present as tribute. I considered it prudent, under the circumstances, to satisfy in some degree the demands of the natives, to make clear to them my friendly views, and at the same time to open my "heart" to them as little as possible, for more than the half of my

African money, viz. cloth, glass, beads, iron, and brass wire, had been already expended on the march to appease our hunger.

Bartering with goods is a terrible business. In Europe it is generally thought that the savages of Inner Africa accept a string of beads or a yard of cotton cloth as a sufficient recompense for dozens of elephants' teeth, and that the nourishment of a caravan is repaid by the honour of the visit. These happy days are long since passed. The savages have advanced from the state of childhood to the years of hobble-de-hoyhood.

After I had arranged all the difficulties regarding my reception in Kitui, and had relieved the people of Ukamba from the fear of my stopping the rainfall, and other dangers which they thought I could cause by witchcraft, and I had paid in many yards of cloth for having the whole road by which I had come strewn with sheeps' entrails, I was but little disturbed in making collections and acquiring information. The rainy season, which had now set in, brought abundant materials for collections; first sprouted the bulbous plants and showed their fleshlike roots; soon the period of their growth ended, and they made way for the grasses and plants which succeeded; then followed shrubs and trees, the latter with leather-like leaves in bloom. The animal world was also in animation. The forest resounded with the songs of the birds. Amongst the latter, the African honey-suckers, with green or violet plumage, glistening brightly in the sun, and, above all, the thrush, the Jenny Lind among birds. The concert of the weaver-birds which build their villages of nests in the hamlets of the Wakamba was also very lively. The African sparrow, "*Passer Swainsoni*," chirps merrily like his European brother. Far away, in the thick forest, may be heard the note of the woodpecker, from which the Wakamba, according to its position to the right or left of the road, or in front or rear of the traveller, foretell good or ill luck, peace or war.

Woodpeckers are to them hated neighbours, and they hang earthen pots on the branches of trees in order to frighten them away from the neighbourhood of the villages.

Still more do they fear the *Trachyphonus*; it is said to kill the cattle when it picks insects from their backs. The "*Schizorhis leucogaster*" is also a caravan bird. The Wasuaheli call it the "*Gnoá*" (forward), from the similarity of its cry. Often the weary porter rouses himself up on hearing the animating cry of the "*Gnoá*." The screech-owl is regarded everywhere in East Africa, as with us, as the death-bird. Other sounds peculiar to Africa are the ear-splitting screeches of the Guinea fowl and Francolin, when they come of an evening to the water, or take up their night quarters on the branches of trees. One day, however, I heard the note of a bird which I cannot for a long time forget. It sounded exactly like the squeaking of the ungreased wheel of a barrow, and awakened in me a feeling, which I once experienced in Arabia, and which I am almost ashamed to confess, of home-sickness.

The men went singing and whistling merrily to the fields, hoping from the quickly growing crops to reap a rich harvest; in like manner the herdsmen saw with pleasure the swelling udders of the kine from the abundance of tender young grass. But where in the world does not one envy another the possession of peace and happiness? The Wakwafi, those pests of Eastern Africa, suddenly invaded the Wakamba villages in our close neighbourhood, drove away the cattle, and killed the herdsmen. They had pitched their wandering camp on the road to Kikuyu, where the snowy mountains lie, which I was endeavouring to reach.

Only three days' march from my station arose the snow-clad Mount Kenia. From one point I was even able to fix the important geographical angle of Kenia-Kilimanjaro. But these three marches were impracticable. A short time before my arrival the Wakwafi had to the last man destroyed a caravan of 1500 armed men. I could not therefore think of the possibility of forcing

with my small escort of armed men a road through their territory: I consequently endeavoured to open friendly intercourse with them, and with this object selected one of my guides, a native Wakwafi, who was joined by several volunteers, to convey to them a friendly offering of white beads, &c.

I myself was at that time suffering very much from an attempt to poison me, similar to that I have previously described.

On the third day my messengers returned to the camp, still out of breath with haste and anxiety. They came to the camp of the enemy, saw the Wakwafi, and fled, throwing away in their haste the friendly presents and even their own provisions.

In the meantime, the Wakamba sorcerers, and the relations of the murdered chief, Kiwoi, were not idle. They stirred up the people and summoned a secret assembly, in which I was condemned to death in expiation of Krapf's offence, and on a complaint that I had gathered stalks of sorghum from the plantations, and had likewise eaten young green beans instead of ripe ones.

One day between 400 to 500 armed Wakamba proceeded to my camp, but on my running towards them with my photographic camera they fled in all directions. They then endeavoured to poison me, but did not completely succeed in their attempts. I also escaped several arrows which were fired at me. One day a grandson of Kiwoi met me with an arrow fixed in his bow and demanded my life. I severed the string of his bow with a cut, and thus disarmed him.

The dread my people entertained for the Wakwafi on the one hand, and for the Wakamba on the other, increased to such a degree that at last they revolted. I succeeded indeed in reducing them to obedience, but I saw clearly that a further stay in Kitui would be quite useless, especially as during my three months' perseverance my stock of goods was very much reduced. I aspired to reach the Kilimanjaro from here, but this plan was also impracticable. The trade route, which was formerly comparatively safe, was now stopped by the Masai hordes. Even seven united caravans had already been detained four months in Taveta, shut in by the enemy.

Ill both in mind and body, I arrived at Mombassa in August, 1877, and discharged all my followers.

I afterwards undertook a short geological excursion, and sailed for Zanzibar in order to arrange and pack my tolerably rich collections. The state of my health continued to get worse. To dysentery, enlarged spleen, and shrunken liver began to be added dropsy in the stomach, so that the doctors earnestly advised me to visit a cold climate. I arrived here (in Berlin) recently, and hope to employ myself during the near future in forming from the mosaic-like ground-work of my experience a picture of the results of my travels hitherto. Then, when I have recovered sufficient strength of body, I look forward to returning to what I regard as my second home.

Perhaps I may then have the good fortune to realise the most eager desire of my life, viz., to open new kingdoms to science and culture.

2. *On Recent Surveys of the East Coast of Africa.* By Dr. J. KIRK.

[Communicated by the FOREIGN OFFICE.]

Zanzibar, December 10, 1877.

I HAVE the honour to report that Commander Wharton, of her Majesty's surveying vessel *Fawn*, has now completed the examination of the coast, including Kilwa, thus connecting his previous work here and on the adjacent coast with the surveys of late Commander Gray, of her Majesty's ship *Nassau*, begun further south.

The chart now completed includes both old and new Kilwa, the Island of Mafia (Monfia), the delta of the River Rufiji, and the inner channel, a most intricate piece of marine surveying, as will appear when the chart of this part of the coast is published.

So far as old Kilwa harbour is concerned, the previous chart of Captain Owen was found sufficiently exact, but alterations even there have been called for, and sailing directions prepared that now make the entrance safe.

Kilwa Kivinji, a place that vessels have hitherto been accustomed to enter with fear, is now shown to possess a safe and easy approach, but the inner passage between the Rufiji delta and the Island of Mafia, from being nearly a blank on the old chart, has been found so locked by reefs and shallows, invisible in the muddy water coming from the many creeks and rivers that here open to the sea, that few vessels are likely to undertake the trouble and risk attending such navigation.

All along this dangerous part, where formerly many vessels have been lost, a refuge may now be found if needed, and the coast approached by vessels with confidence, while an immense facility has been given to any attempts at extending trade in the rich alluvial lands where the best sorts of rice are grown, and the semi-fossil gum copal found in greater abundance and of better quality than elsewhere.

The Rufiji delta, which extends over 40 miles here, furnishes an almost inexhaustible supply of mangrove wood, which is shipped to the Red Sea and Arabia, and known as Zanzibar rafters. In the forests and jungles of this region also the india-rubber vine (*Landolphia*) is plentiful, and the product beginning to be collected by the natives in proportion as the slave trade diminishes.

By ascending the Rufiji to a point above the delta, Captain Wharton has also been able to add something to our knowledge of the rivers of Africa, a subject that at present attracts considerable attention among geographers. The Rufiji was first entered and examined by Captain Wharton and myself in 1873. As it seemed probable that other branches besides those we then explored passed off from the main stream higher up and opened to the sea by one or other of the numerous creeks which we had not time to examine, I ordered Captain Elton, then Vice-Consul here, to cross the main stream on his land journey to Kilwa as high up as possible, and take observations of its dimensions and capabilities.

After that Mr. Stanley, previous to entering Africa on his second journey, visited the Rufiji, and published in the *Daily Telegraph* an account of what he saw. Mr. Stanley's description is now found to be exaggerated and inaccurate, nor did he succeed in reaching as far as Captain Elton's crossing at Mpembeno. Captain Wharton, by passing that station, has now added a considerable amount of reliable information to what was before known of the river, and has accurately laid down the course of the stream and its many mouths for a distance of 20 miles, in a straight line inland, being a few miles beyond Mpembeno, the chief trade crossing, and the point where Captain Elton and Lieutenant Pullen made their observations. Captain Wharton finds that when the inundations have subsided so as to allow boats to stem the current in the river, the channel becomes obstructed by many shoals and sandbanks, that render navigation difficult for anything larger than a steam cutter. In the month of November, when the river is probably at or about its lowest, the steam cutter of her Majesty's ship *Fawn*, drawing 3 feet, ascended 30 miles of river, being then 20 miles distant in direct line from the sea, carrying in general a narrow but deep channel of 9 to 10 feet, reduced, however, at one or two places by shifting sand-bars, that obstruct the river from side to side, and on which not more than 2 or 3 feet of water was to be found; over these the steam cutter was forced with difficulty. So far as

could be seen in front of Kisoma, the highest point reached by Captain Wharton on this occasion, the river was still navigable to boats, but natives said that it became more encumbered with sandbanks, and shallower than below. Little dependence is to be placed, however, on what the people said, as they did not profess to have gone far up it themselves. Here the population also ceased, this being the commencement of an uninhabited belt cleared of people by the ravages of the slave trade.

The river at Mpembeni, although 300 yards from bank to bank, which during the flood caused by the rains would be filled, had in November contracted to a water-channel only 80 yards across.

Captain Wharton found several branches given off from the main stream between Mpembeni and the point where it had before been examined in 1873; these open by distinct mouths to the sea.

The three principal embouchures of the Rufiji are first the *Msala*, which is the main or direct mouth, narrow, however, and liable, as in 1873, to be rendered impassable by sand-bars across its channel. Firm land is sooner reached by this than by any other of the mouths; it is called higher up the Bumba Branch, and has at present a general depth of 2 fathoms, while the width varies from 150 to 80 yards. Secondly, the Simboranga, a splendid deep creek, used chiefly by woodcutters in search of rafters. And thirdly, the Kikunia, or main trade entrance, $2\frac{1}{2}$ miles wide at the mouth, with not less than 2 fathoms at the entrance at all times of tide.

Captain Wharton proposes now proceeding to Kismayo and Lamu, for the purpose of making plans of these harbours before the strength of the north monsoon has set in, when he will return and complete the chart of Tanga, previous to going to the Cape, as he has been ordered to do, during the rainy season, for the benefit of the health of the ship's company.

3. *Brief Report on his recent Journey to Sinai.* By the Rev. F. W. HOLLAND.

June 2, 1878.

DEAR SIR,—I arrived in England yesterday, having as far as my limited time (ten weeks) allowed me, completed the work for which the Committee was kind enough to grant me a loan of instruments. Leaving Suez on April 1st, I journeyed almost straight to Jebel Musa (Mount Sinai), merely stopping on my way a few days to examine the country between Serābit el Kādīm and Wady Mughārāh, the two well-known mining districts of the ancient Egyptians, and the course of Wady Sahow. I could find, however, no traces of any Egyptian turquoise mines or inscriptions here.

On leaving Jebel Musa I examined every pass leading northwards over the ranges of Jebel et Tih and Jebel el Ojmeh, and followed the course of every wady that I had not previously examined, and which might have afforded a road for the Children of Israel on their journey northwards from Mount Sinai to Kadesh. Finally, I travelled northwards by W. el Ain and W. el Atīyeh, along the route described by Baron Koller in 1840. This affords a broad and easy road without any difficult mountain passes, and is the *only possible route* that the Israelites, with their vast numbers, could have taken in a journey northwards. I found that little rain had fallen for two years, and that the country was much parched up. The want of water and the constant raids made by the Maāzi, and other Arabs from the east of the Arabah, made travelling difficult, but I succeeded in exploring Jebel Mughrah, and here and in other parts of the country I have made some important additions to the knowledge of its geography which, when my maps are completed, will I believe

prove of considerable importance, as they will throw some light upon the position of Kadesh Barnea, and the boundary of Edom, and the Negeb. I explored thoroughly Ain Gadéis. From this point I discovered and traced out an ancient road running due west to Ismailia, through a mountainous tract that had, I believe, been previously unexplored. At Jebel Mugrah I found very extensive traces of former cultivation, and ruins of primitive dwellings and tombs, besides large quantities of flint flakes and arrow-heads. The importance of the road to Ismailia was shown by similar remains, and by the character and number of the wells. I also obtained some interesting information with regard to the supposed change of climate in the Isthmus of Suez, owing to the canals, and the increase of cultivation along the line of the fresh-water canal. I have only time now to write hastily these few notes on the result of my expedition, in order that you may lay them before the Committee at the meeting to-morrow.

To the Assistant-Secretary of the Royal Geographical Society.

4. *On recent Measurements of the Depth of Swiss Lakes.* By
Professor PAUL CHAIX, Hon. Corr. Member, R.G.S.

I LATELY sent you two sheets of the map of the Lake of Geneva, published by M. Ed. Pictet, Lieutenant-Colonel of the Engineers. The author, by the gift of a new copy of that map, has desired that the former one should be presented in his own name to the Royal Geographical Society.

Will you allow me to avail myself of this opportunity to give you a statement of what has been done in our country towards the study of the depths of our lakes? It is some twenty years ago since M. Guyot, a distinguished geographer of Neuchâtel, undertook, with Count de Pourtales-Gorgier, a complete study of the Lake of Neuchâtel, by a number of sections measured across its basin based on about 1100 soundings. The distances between the points measured were given by the number of strokes of the oars in their rowing-boat, after their length had been ascertained by numerous experiments. Although this mode of working seems unable to lead to very accurate data, the authors were induced by experience to admit them as faithful.

The result has been to ascertain that the Lake of Neuchâtel is divided into three parallel zones, preserving its general direction from north-east to south-west. The first and deepest, keeping close to the foot of Mount Jura, sinks to a depth of 422 French feet, or 137 mètres to the south of the town of Neuchâtel; the second and almost middle zone is 200 feet less deep; the third one, on the south-east shore of the lake, lined with cliffs of sandstone, is seldom more than 30 feet deep. Two shallow tracts form the extremities of the basin, towards Yverdon, on the south-west, and at the lower end of the lake, on its north-western extremity, with seldom more than 20 and 30 feet of depth. But the most curious result has been the discovery of a crest on the limit of the first and the second zone, on which the depth is not more than 30 feet, and which is parallel to the north-east and south-west direction of both shores. It is formed of sandstone, and seems to find its prolongation in the well-known island of St. Peter's in the Lake of Bienné.

The subsiding of the waters of the lake would thus uncover one-half of its bottom, reducing its extent to the first and second zones, with an island in the middle.

The curious results of MM. Guyot and Pourtales' work have led to a similar and much more difficult study of the depths of the Lake of Geneva. For the oldest data on the subject we are indebted to Sir Henry T. de la Beche, who measured the depths and temperature of 89 points, and wrote an account of his observations in a letter to Professor Pictet of Geneva, which

was printed in vol. xii., p. 118, of the 'Bibliothèque Universelle,' Geneva, 1817, and was our guide for half a century.

The study of the Lake of Geneva was prosecuted with the pecuniary assistance of several learned societies and public bodies. M. Ph. Gosset, an engineer of the Federal Topographical staff, undertook during the summer of the year 1873, on that part of the lake which spreads from Saint Sulpice on the west, to Saint Saporin on the east, a series of 1450 soundings, connected by a net of triangles and cross-sections, and carried them across to the opposite shore in Savoy. He applied to that difficult task a degree of precision creditable to the topographical staff. They are embodied in sheets 438 bis, 438 ter, 440 and 440 bis, of the topographical atlas of Switzerland, on the scale of 1 to 25,000.

An account of it has been written by Dr. Forel, of Morges, and printed in vol. lii. of the 'Bibliothèque Universelle, Archives des Sciences Physiques et Naturelles.' The number of soundings has allowed the tracing of parallel curves, 10 mètres apart vertically in the depths of the lake. They generally agree with Colonel de la Beche's measures, although 20 of his soundings only are included within the limits of M. Gosset's four sheets.

The northern shores present their steepest slopes opposite Rivaz, at the foot of the hills of Chexbres and the shore of Savoy, opposite the Leucon, between Meillerie and Saint Gingolph, the sounding-lead descending in both cases to a depth of 245 mètres, at a distance of 500 mètres from both shores. Opposite Evian and Ouchy, a depth of 315 mètres is reached at a distance of 3 kilomètres from the shore, and the same at 5 kilomètres in front of Saint Sulpice.

The general bottom of the lake is a plain of 6 kilomètres width, with two shelving sides. It is flat everywhere, offering none of those upheavings and rocks, the presence of which has been ascertained by M. E. Pictet's more recent observations in the south-western part of Lake Leman. Cross-sections, carried in a perpendicular to the general direction of the lake, have only proved the existence of upheavings and subsidings of the bottom within the limits of 10 mètres in height. All moraines of glaciers and faults of the bottom that may have existed lie buried under a uniform bed of clayey mud of great tenuity. In this bottom the greatest depth is to be found at 334 mètres, below the average level of the lake, on a line between Ouchy and Evian, 41 mètres above the level of the sea, and 34 mètres lower than the greatest depths measured by Sir Henry de la Beche. There is not, however, any longitudinal depression of the bottom of the lake that might be mistaken for its "thalweg"; just the reverse, as a trifling upheaving of the axis is observed, the origin of which cannot be guessed as long as the soundings have not yet been carried to the easternmost extremity of the basin. Then only will it be ascertained whether it is to be traced to an alluvial deposit of the Rhône.

The flat bottom of the lake goes on sinking 105 mètres along a median line from the front of Saint Gingolph to the cross-line Ouchy-Evian, where it reaches its greatest depth. The same rate of slope is preserved from the same place to the eastern extremity, direct soundings giving a depth of 100 mètres opposite Montreux, 80 before Chillon, and 60 in front of Villeneuve.

While the eastern part of the Lemanic basin was thus explored as a branch of the public service, it was, with no less activity and no less accurate results, studied in its western or lower part by the spontaneous and gratuitous exertions of our fellow-citizen, M. Edward Pictet, Lieutenant-Colonel of the Engineers. Having been for twenty years in pursuit of ornithological studies and of sport, well inured to the hardships of a sailor's life, grappling with stormy weather and intense heat, M. Pictet was, more than anybody else, qualified to master practical and sometimes perilous difficulties of observation. Living on the west shore at Genthod, the south-west basin of the lake became

his field of observation, to which he applied an efficient and well-manned craft of 7 mètres in length and 1·40 mètre in width. His original plan was, in June 1873, limited to the measurement of a cross-section of the lake between Genthod, his own seat, and Bellerive on the left shore of the lake, and was, by degrees and by the adoption of improved methods and instruments, developed into a well-conceived plan for the execution of a true geographical monument of notable usefulness.

It has resulted in a series of 155 cross-sections, by which M. Pictet was enabled to draw a number of horizontal curves, 5 mètres apart from each other in height, instead of 10 mètres as adopted by M. Gosset. M. Pictet has also, for accuracy's sake, adopted the scale of 1 to 12,500 instead of 25,000, the scale of the Federal staff. Those only who are aware of the practical difficulties attending maritime surveys elsewhere than in the Greek Archipelago, those who remember how many years Smeaton was delayed by stormy weather in the building of the Eddystone lighthouse, will understand how few, in our hilly country, are the days of which a surveyor will be able to avail himself of a fine weather and an unruffled lake. June, July, and October are almost the only months available; and, as for his observations in the close neighbourhood of the shore, M. Pictet found that precision was not to be depended upon unless he observed in the forenoon on the left or eastern shore, and in the evening on the western shore; he was compelled to start from Genthod before daybreak when he intended to survey the left shore in front of Hermance, Anières and Bellerive.

The amount of good surveying done under favourable circumstances in one day of fine weather, implied at least three days of bad weather employed in the calculation, working and drafting of the results, so that there was work enough for a whole month in ten days of good field-work.

As the survey of General Dufour had been made thirty years ago, Colonel Pictet judged it necessary to order a re-examination of the changes undergone by the shore-line, on account of the destruction of the fortifications and of the erection of dams and buildings. For the level of the lake he adopted the number 375·03 mètres above the level of the sea, borrowed from Dufour, and admitted it as being 1·61 mètre below a brass plate fixed on the rock called Pierre du Niton. Colonel Burnier had, it is true, considered as a more exact line of level 1·69 mètre below the brass plate. The appreciation of the true average level of the waters of the lake has undergone a still greater alteration, since M. Michel, of the French Ponts et Chaussées, starting from the Mediterranean, carried a direct levelling up to the Lake of Geneva, and settled that its level, hitherto reckoned to be 375·03 mètres, was only 373·252 mètres above the Mediterranean, and 371·569 mètres above the mean level of the ocean on the coasts of France. It must, however, be acknowledged that these discrepancies do not interfere with the soundings of the author of the map.

The degree of precision he was aiming at led him to give up the use of a hemp-line for the soundings, and of rowing as the measure of distances: a hemp-line being still liable to errors, even when tarred and corrected for contraction; while with the strokes of the oar there is still a difficulty in keeping the boat steadily on the line measured, and to stop whenever unexpected variations or the occurrence of boulders in the depth make it desirable to multiply the soundings. M. Pictet's line is made of a metallic cord divided by copper-rings every 5 mètres, rolled inside the boat, and given out by a pulley with a deep groove a little behind the stern of the boat. The sounding-lead is a ball of 3 kilogrammes weight.

The descriptions of the instruments and of his surveying process have been published by M. Pictet in a very comprehensive paper in vol. lii. of the 'Bibliothèque Universelle, Archives des Sciences Naturelles,' p. 14. The use of a single sextant to measure the angles, having their summits at the observed

point of sounding, and formed by the transverse line and a second line connecting the point of sounding with a fourth point—such, for instance, as the tower of St. Peter's Church at Geneva—is subject to the difficulty of keeping the boat exactly on the straight line of the cross-section, while the observer is busy with the reading of the first angle and the measuring of the other. M. E. Pictet has corrected that defect by the use of three sextants for the almost simultaneous measure of all the angles, a method which allows full time for reading at leisure the results of the three observations. As the sum of the two angles on one side of the cross-line must theoretically amount to 180° , it is easy to correct an error in case the sum is found 179° or 181° , for instance, by which a deviation to the north or to the south may be guessed and corrected by means of a station-pointer, such as is made in England.

The use of the sextant, being difficult for stations measured very close in-shore, has been replaced by M. Pictet for such stations as are distant less than 1 kilomètre, by the *Telemètre Lugeal*, in which the object-glass is divided into halves, capable of being brought one over the other.

Let us now form an idea of the results of the surveying operations, as they are consigned in two sheets, beautifully executed, on the scale of 1 to 12,500. As a rule, the almost flat zone along the shore of the lake, called by the fishermen *baigne*, is followed by a more abrupt slope called *Le Mont*. Its greatest inclination is, in front of Hermance and Chevrin, of 40 mètres for 120 mètres of horizontal distance, or 1 to 3, while the width of the breadth of the latter zone or *baigne* on the right shore is comprised between 200 and 500 mètres. The width of the lake itself is 4000 mètres between Coppet and Hermance or Chevrin. A sort of flat bottom occurs in the middle of this western part of the lake, as well as in the eastern part, with an average depth of 60 mètres and a breadth of 2000 mètres. In this flat bottom a basin is sunk to about 70 mètres, or 304.6 mètres above the level of the sea in front of Chevrin, and at a distance of 1400 mètres from it. Another tract, formed of the southernmost extremity of the lake, spreads from Geneva to a distance of 2400 mètres towards the north-east, as a kind of shoal, not deeper than 10 mètres to 15 mètres, namely between the horizontal lines of 375 and 360 mètres.

Twenty-three erratic boulders are spread over the bottom of the lake, ten of which are clustered in a spot north-east by north of Bellerive. One of the largest rests on the top of a kind of hill or upheaval of the bottom called *les hauts monts*, which occurs 2000 mètres north of Bellerive, 10 mètres below the surface of the lake, with an extent of about 25 hectares, and has for its upper limit the curve of 365 mètres above the sea. It is connected with the eastern shore of the lake by an isthmus, where the depth reaches 15 mètres, and is well stocked with the above-mentioned boulders.

The surface of the lake, as comprised in M. Pictet's map at the level of 375 mètres above the sea, is of 4333 hectares, and is reduced by gradual sinking to 3593 hectares at the level of 370 mètres, to 3220 hectares at 365 mètres, 3035 hectares at 360 mètres, 2318 hectares at 340 mètres, 1659 hectares at 330 mètres, 1325 hectares at 325 mètres, 788 hectares at 315 mètres, 214 hectares at 310 mètres, and 17 hectares at 305 mètres above the sea, or at the depth of 70 mètres below the surface.

AFRICAN EXPLORATION FUND.

ROYAL GEOGRAPHICAL SOCIETY.

June 14th, 1878.

SIR RUTHERFORD ALCOCK, K.C.B., PRESIDENT, in the Chair.

MEETING OF THE SUBSCRIBERS TO THE AFRICAN EXPLORATION FUND.

A MEETING of the Subscribers to the African Exploration Fund was held this day, 3 P.M., at the Hall of the University of London, according to a circular announcement previously sent to all Subscribers, and in conformity with paragraph 8 of the Minute of Council appended to the original Circular of the Fund issued in May 1877. The following Report of the Committee, sent to each Subscriber, was taken as read.

REPORT of the AFRICAN EXPLORATION FUND COMMITTEE to the COUNCIL, May, 1878.

THE Council of the Royal Geographical Society, in its minute of the 12th of March, 1877, constituting the African Exploration Committee, under Section 8, made provision for a meeting of the Subscribers to the Fund once a year, "for the purpose of explaining the progress made in Exploration, the mode in which the Exploration Fund is being dealt with, and ascertaining, as far as possible, the views of Subscribers in relation to the Fund."

In view of this provision, it is time for the Committee to report progress, and to submit such recommendations as in the present state of African discovery and exploration may seem expedient, in furtherance of the objects contemplated in establishing an African Exploration Fund.

The return of Mr. Stanley from his explorations in Africa, extending over three years, and ending in the discovery of the course of the Congo from Nyangwé to the Yellala Falls, is the greatest geographical event of the year, and it is one which must have an important bearing on all future plans of exploration in the African Continent. Not only for the reason that the greatest of the problems that remained in African geography has now been solved, and the area of discovery has become thereby more restricted, but also on account of the large amount of new information which it is in Mr. Stanley's power to give, regarding the practicability of traversing many regions which it may be thought desirable to explore.

The increased activity of Governments as well as Societies in promoting new expeditions, and the general interest manifested in the progress of African Exploration, as shown by the enthusiastic reception given to Mr. Stanley on his way to England from the Cape, viâ Zanzibar, Egypt, Italy, and France, where not only Geographical Societies, but Sovereigns and Governments, vied in bestowing honours on the successful traveller, sufficiently justify the action taken by the Council last year, in instituting and supporting an African Exploration Fund. The Royal Geographical Society can justly lay claim to the honour of having initiated the great movement in African exploration which is now taking such large proportions, and attracting the interest and co-operation of so many nations. Captain Burton's Expedition to Lake Tanganyika in 1857, was in effect the commencement of all modern geographical enterprise in East Central Africa, although Livingstone preceded him by some years in the work of exploration further South.

Such being the past history of this modern movement, in which so many Institutions, Societies, and Governments are now interested and actively engaged, the question may naturally be asked,—what is the position which the Royal Geographical Society ought to occupy with regard to the whole subject of African exploration and its future direction?

It is obvious that although comparatively rich, from the number of its contributing members,—the Society cannot compete with Governments or even with Missionary Societies in explorations on a large scale, having neither the powers of the first, nor the pecuniary resources of the second. Nor is it able to embrace the same objects, restricted as it is by its constitution to Science and Geography, while the action of States and many societies and public bodies is unfettered. Thus, the German Society can take Commerce within its range, and obtain a Government grant in aid. The 'Association Internationale Africaine' in Brussels in like manner includes objects of philanthropy; while the various Missionary Societies devote themselves to religious ends. These objects all powerfully appeal to stronger feelings and more universally recognised interests than any connected with pure science or geography, and therefore receive greater support. In Portugal a grant of 20,000*l.* for the exploration of Western Africa beyond the confines of the Portuguese possessions has been made by the Cortes. In France, still more recently, a credit of 100,000 francs has been voted for a Central African Expedition, and in Belgium an income of nearly equal amount has been contributed by subscribers to the International scheme for the Exploration of Africa; while the total amount hitherto received by the African Exploration Fund, including the 500*l.* granted by the Council, has not reached 2000*l.*

Thus restricted in their objects and means, the African Exploration Fund Committee have not hitherto considered themselves in a position to undertake any independent expedition. It has even been questioned whether the action of the Committee, or of the Council from which it emanates, should take this direction at all, or be limited to making grants in aid of expeditions organised by others, and discussing and publishing results? Such, indeed, until recently, has been considered the chief function of the Royal Geographical Society, and it might be argued that further useful work may be accomplished by collecting and disseminating the best information. This,

however, is what is now being done by another Committee of Council, which is directing the compilation of a very complete map of Tropical Africa on an unusually large scale. In compiling and publishing the very best maps and memoirs, and supplying a centre where explorers, both British and Foreign, may claim attention for Papers or Lectures at the Evening Meetings of the Society, a valuable amount of assistance is no doubt rendered to the cause of African Exploration, as to every other scientific and geographical exploratory work.

The Committee have, however, carefully considered whether, in addition to this, the funds now at their disposal may not usefully be applied in organizing an expedition on a small scale, which, if carefully planned and successfully carried out, might effect some of the results for which the Committee was more especially constituted.

Upon a retrospective survey of discovery and exploration during the past year, which will be found in the President's Anniversary Address, it is impossible to avoid a painful impression of the sacrifices entailed on those who undertake the perilous work. Were all the inhabitants of Africa equally hostile and intractable, it might well be doubted whether any more lives should be imperilled in efforts for the redemption of the country and of the whole race from barbarism and slavery. But there is abundant evidence that only certain tribes and regions are dangerous to approach; while vast tracts capable of supporting an agricultural and industrious population, if cultivated, are only waiting the hand of civilised man, and a Christian spirit, to establish, with willing aid from native tribes, peaceable communities over the greater portion of Central Africa; from the Equator to the Zambesi, and from sea to sea across the whole breadth of the continent. Enough is known to justify the supposition that from eighty to one hundred millions would not be an over-estimate of the population cruelly oppressed and kept in hopeless barbarism by the tyranny and violence of comparatively small numbers of predatory and bloodthirsty tribes. If these could be held in check but for a short period, while peaceable influences had time to work among the better disposed of the populations, there is every reason to believe that a sufficient number of these would soon be collected into communities and villages, able successfully to defend themselves and their possessions under European guidance. It is this prospect, with the hope and promise of early fulfilment, which has undoubtedly induced so many, up to the present time, to risk not only health and fortune but the perils of martyrdom, rather than allow the great end in view to be abandoned. And with an object so important and worthy, it is unlikely that there will in the future be any lack of the enterprise which sends volunteers into the field, ready to take the place of those who fall in the first advance.

In connection with this part of the subject, the Committee would draw attention to the purport of the Instructions framed for the guidance of the Belgian Mission lately despatched to Africa by the International Commission sitting at Brussels. These instructions are eminently pacific,—as your Committee think they ought to be in every case in which an exploratory Expedition is despatched, whether Scientific, Missionary, or Commercial in its object,—and are to the effect that in all their operations the head of the

party must remember that his mission is essentially peaceful, and consequently that he will have recourse to force only in self-defence, and at the last extremity. To this general principle must be added the instruction to pay for all they require, whether labour, food, or stations, and if need be for a right of way peaceably conceded, and this Committee is of opinion that no better rule could be desired for the conduct of any Exploratory Expedition, and nothing more is needed, than the faithful adherence to such rules of action, to justify the continued prosecution of exploratory work, with all its contingencies.

It remains only to bring under notice the several schemes of exploration which have been under the consideration of the Committee. An expedition has been proposed by Mr. Keith Johnston, having for its object the exploration of the country between Mombas, Formosa Bay, or other point on that part of the coast, and Victoria Nyanza, passing by Mount Kenia. Mr. Johnston has stated that "No part of unexplored Africa appears to present more attractive physical features for examination than this plateau between Mount Kenia and the Lake regions, and none could be more interesting from an ethnographic point of view, as it is the debateable land in which the great races of Eastern Africa, Hamitic, Semitic, Negro, and Bantu, meet and interlace." On the other hand, the region in question is reported by Dr. Hildebrandt and others to be one of the most dangerous on the continent, owing to the hostility of the Māsai tribe. Large Arab caravans, according to Dr. Hildebrandt, have been recently slaughtered. In one, he states, of 1500 men all were killed to a man, and Mr. Johnston himself believes the only reasonable hope for the successful issue of a geographical expedition in this direction would be in its adding its strength to that of one of the large Suaheli caravans. There are many serious objections, however, to such a combination, with undefined responsibilities, as to the means which might be employed by such allies to overcome the obstacles created by hostile natives; and whatever may be the importance of opening up the trade-routes from the Victoria Lake region to the Eastern Coast, this is scarcely an object within the province of the Geographical Society. It is true that Mr. Wakefield, a missionary of long experience in that region, expressed his willingness to undertake such a journey, and does not think it impracticable without any protective force, if his Society had given their consent, but this at present they have felt it necessary to withhold.

Two other courses have been suggested:—one by Mr. Stanley, which is to examine the valley of the Rufigi, from its delta to its sources in the highlands bounding the eastern side of Lake Tanganyika; an undertaking which could be carried out with comparative safety, and would yield some valuable geographical results:—the other, the exploration of the country intervening between the caravan road now constructing from Dar-es-Salaam (a few miles south of Zanzibar) and the northern end of Lake Nyassa. This second project commends itself to a certain extent by the service it might render to a party already engaged in the useful and important work of making a road in this direction into the interior, with the aid of English engineers and the sanction of the Sultan of Zanzibar. But such an expedition as is now suggested, if resolved upon, should only take its point of departure—perfectly untrammelled and independent in its ulterior progress—from the present termi-

nation of the road, and make a general preliminary survey of the whole line of country intervening between it and the northern end of the Lake. According to the recent description given by Mr. Cotterill of part of the country through which the proposed track would run, the region offers great attraction in the grandeur of its physical features, and is likely to yield discoveries of great geographical interest, independently of its practical importance in connection with the question of the best trade-route to the lakes. Should the expedition reach Lake Nyassa, a distance of 350 miles from Dar-es-Salaam, without much difficulty, the position thus gained would serve as a starting-point for a more important exploration to the southern end of Lake Tanganyika, a further distance of 190 miles, thus completing approximatively Nos. 3 and 4 of the routes proposed in the Circular issued by the Committee. The return journey might be over new ground, as near as may be to the course of the Rufigi. For this undertaking, if decided upon, the Committee think Mr. Keith Johnston would be well fitted; and a second person might be associated with him, duly qualified, with medical experience perhaps, to attend to various branches of science other than pure Geography and general survey, which would be the special duties of the leader.

The Committee believe that the above would constitute a well defined scheme of moderate dimensions and practical character. To open up the interior of Africa, they believe the work required must be of a progressive and steady character, and not too ambitious at first, or beyond the real exigencies of trade and civilising efforts to which geographical exploration is the pioneer. In this view, the indication of a line of communication from north to south, through the great chain of lakes, by supplying the missing links in geographical knowledge, is no less important than pointing out the best line of communication from the lakes to the coast east and west. The expedition here contemplated would combine both these objects. The north-west shore of Lake Nyassa is, according to the latest accounts from the natives, only 150 miles distant from Lake Tanganyika, and over a tolerably level line of country. A path, or caravan route, already exists, it is said, and the chief aim would be in following this to investigate the surrounding country, and if possible gain the goodwill of the people. If the link between the two lakes could thus be made, and a steamer placed on each—of which there seems to be fair promise—a long line would be opened through the central regions, while the return journey through the intervening country to the east and west, would go far to complete the line of communication it is sought to establish in that direction, as one of the essential conditions of enlarged intercourse and greater facility of access to the central plateau and lakes.

Having carefully considered these several fields of exploratory labour, your Committee recommend the last-mentioned as the best calculated to yield valuable results within the compass of the means at their disposal, which amount at present to 1400*l.*; or, assuming that the Council might be disposed to make a further grant of 500*l.*, to 1900*l.* This would be irrespective of subscriptions which may be expected from the public, when an exploration of so practical a nature is announced as definitively resolved upon, and a fresh appeal made.

The Expedition to Victoria Nyanza originally traced out by Mr. Keith

Johnston, apart from other objections and the danger of the route, could not be safely estimated to cost less than 2500*l.* in two years, subject to various contingencies which might indefinitely increase the amount required.

The annexed financial statement of receipts and expenditure to December 31st, 1877, will show the total amount received to that date, and the several items of expenditure incurred. Only £250, it will be seen, have hitherto been devoted in aid of any expeditionary operations, by a grant to that amount made to the Association Internationale Africaine at Brussels. The total amount received to the 31st of December, 1877, was £1835 8*s.* 6*d.*, of which £183 2*s.* 0*d.* were in annual subscriptions, and the balance in the hands of the bankers and the accountant on that day was £1319 9*s.* 3*d.*, after payment of the above-mentioned contribution of £250 and £265 19*s.* 3*d.* for printing, maps, advertisements, expenses of Mansion House meeting, and office contingencies, in all £515 19*s.* 3*d.*

The total receipts from the commencement of the fund to the end of March amounted to £1932 18*s.* 1*d.*, the cash balance in the hands of the bankers and the accountant being then £1404 2*s.* 10*d.*

RUTHERFORD ALCOCK,

*Chairman of African Exploration
Fund Committee.*

* * The above Report having been adopted by the Council, it has been finally determined to despatch a small Expedition to explore the country between Dar-es-Salaam and the northern end of Lake Nyassa. Mr. Keith Johnston has been appointed commander, and he will be accompanied by a second European. He will leave England for Zanzibar in October next.

The Council, at the same time, have made a second grant of £500 to the Exploration Fund.

RUTHERFORD ALCOCK.

June 1st, 1878.

In opening the proceedings, the CHAIRMAN said he regretted that the Meeting was not more fully attended, but he was not greatly surprised at it at this time of the year, when people were so much occupied. He fancied that an idea had got abroad that the real business of the Meeting was purely formal. So to a certain extent it was, for the only business he had to bring before them was the reception of the Report, showing that the Royal Geographical Society was carrying out the Minute of Council quoted in the Report, which all present had had the opportunity of reading. In his Anniversary Address he had given a very full and detailed account of all the work that had been done in the way of African Exploration during the past twelve months, so far as he could ascertain it; therefore he would not attempt to go over the same ground again. In the Report, too, there was also some reference to the past, and a distinct statement of the views of the Committee as to what, with the means at their disposal, might be attempted in furtherance of the great object of African Exploration.

Commander V. L. CAMERON seconded the motion. He was, he said, very glad to find that the Fund had to a certain extent assisted the Belgian

AFRICAN EXPLORATION FUND.

BALANCE SHEET TO 31ST DECEMBER, 1877.

<i>Receipts.</i>		<i>Expenditure.</i>	
	£ s. d.		£ s. d.
Donations	1649 19 3	Printing and Maps	122 16 9
Annual Subscriptions	182 2 0	Advertising the Fund	31 15 6
Do. paid in advance	1 0 0	Expenses of Mansion House Meeting	26 12 10
Sale of Circular	2 7 3	Amount contributed to the International African Commission at Brussels	250 0 0
		Office Contingencies, including stationery, postage, parcels, &c.	84 14 2
		Balance at Bankers' on Dec. 31 .. £1310 10 0	
		Do. in Accountant's hands, Do. .. 8 19 3	
	£1835 8 6		1319 9 3
			£1835 8 6

Audited and found correct, 4th April, 1878.

S. WM. SILVER, }
C. WESTENDARP, } *Auditors.*

We further certify that we have examined the books of account for the first quarter of the present year, and find the subjoined statement to be correct:—

TOTAL RECEIPTS FROM THE COMMENCEMENT OF THE FUND TO MARCH 30, 1878 .. £1932 18 1
CASH BALANCE ON MARCH 30, 1878 £1404 2 10

S. WM. SILVER, }
C. WESTENDARP, } *Auditors.*

4th April, 1878.

Society, after the noble way in which the King of the Belgians had come forward with his great international scheme. The survey of the route to the north end of Lake Nyassa would be a most important piece of African Exploration. Recently Captain Elton, whose death they all lamented, and Mr. Cotterill, had joined the southern route with those in Ugogo. Colonel Gordon and Sir Samuel Baker had ascended the Nile; Colonel Grant and Captain Speke had passed through from Ugogo to the Victoria Nyanza, thence down the Nile; and Stanley's journeys had formed a connection with Livingstone's from the north of the Transvaal. Africa had thus been traversed from north to south, as well as from east to west. The route from Dar-es-Salaam would form a most important addition to our knowledge of those available for trade, and he wished Mr. Keith Johnston all success in his enterprise.

The Resolution was agreed to.

Mr. HENRIQUES said it was with extreme diffidence that a drawing-room geographer like himself ventured to express an opinion upon a Report so ably drawn up, especially after it had been spoken to by distinguished practical geographers. It would, however, appear that the chief difficulty in the way of African Exploration was the want of funds. The appeal to the public had, to say the least, not been successful, and the amount subscribed to the Fund was so trifling that any grand scheme of Exploration was entirely out of the question. In reading the Report he was struck by its exceeding clearness, and its apologetic tone which disarmed criticism; but he thought it would be better for the interests of geography in future if action were delayed for a year or two. The most important scheme that had been before the Committee was the exploration of the route from the coast near Mombasa to the Victoria Nyanza. It was very important to trace the route through the mountainous country by the side of Mount Kenia. There were at present no funds sufficient for this undertaking, but by the end of another year sufficient money might be obtained. Mr. Stanley had stated that M'tesa was the most prominent man in Central Africa. To obtain his concurrence in the work of civilisation seemed to him to be one of the grandest ideas of modern geographers. To that end a direct route ought to be opened up to his dominions. Bearing all this in mind, he thought the Committee would better keep faith with the public if they delayed sending out an Expedition for one or two years.

Mr. F. HOLMWOOD had seen by the Report that after discussing the various routes from the East Coast to the interior, the Committee had chosen that from Dar-es-Salaam to the northern end of Lake Nyassa. During the last five years, in assisting Dr. Kirk in suppressing the slave-trade, he had had to visit the whole of East Africa, from Somali Land down to Mozambique, and of course had made inquiries of the natives he had met with as to the different routes into the interior. He had come to much the same conclusion as that set out in the Report, that there were four principal routes from the East Coast. The first was from Brava to the Bahringo district, passing the Juba River at Berdera, to which point there was a camel route. The second was from the Mto Tana or Pokomo River, which was fed by the snows of Mount Kenia. It commences by a canoe journey of some two hundred miles, and afterwards passes through two very fierce pastoral tribes, to the east and perhaps the north-east of the Victoria Nyanza. The third route was from Mombasa, by Chaga (Kilimanjaro), to the south end of the Victoria Lake; and the fourth route was from the coast opposite the south end of Zanzibar through Uzaramo, across the Rufiji, to the northern end of Lake Nyassa. He considered that the relative importance of these routes was in the order in which he had named them; but from the Report it appeared that the funds at the disposal of the Committee were to a certain extent limited. From his experience in Eastern Africa, and his knowledge of the present rate of portorage, it was, he considered,

utterly impossible to undertake either of the first three journeys with the funds at the disposal of the Committee; but the fourth, from Dar-es-Salaam to the north end of Nyassa, was quite within the scope of those funds. If the Expedition succeeded, it would no doubt be easy to collect sufficient funds to undertake the other three journeys. In connection with the fourth route he would make one remark with reference to the route across to the Rufiji. When, in July 1876, he was engaged in an exploration of the Kingani River and discovered the mouth of the Lungeregere, he was one morning taking bearings from the adjacent high ground, and he observed to the south-east the faint outline of a group of isolated hills, hardly to be called mountains. He could not judge the distance, but his guide, who was a celebrated Mkami hunter, informed him that he had been there; that the hills were the centre of a large forest, named Gongoroma. He described it as about 40 miles from where they stood, and if that were so it would be about $7^{\circ} 50' \text{ s.}$, and $38^{\circ} 50' \text{ E.}$ He said it was a comparatively dry country, with two or three small rivers running through it. He seemed to think the forest was about two days, or not more than 50 miles in length, and about the same in breadth. He considered it one of the finest elephant countries in that part of Africa, and every year a large number of Makuas were in the habit of going there to hunt the elephants and take the tusks down to Kilwa. That information was fully confirmed by Sahale, the chief of Dundanguru, who remembered Grant very well, and who would be delighted at any moment to assist Mr. Keith Johnston, and even go with him to the forest. He hoped that Mr. Keith Johnston, after leaving the road now being made from Dar-es-Salaam, would strike across either to Mzezero, or one of the places on the line from Konduchi to Sagasera, and then strike south to the forest of Gongoroma. If he could do that, reach the Rufiji, and so get to the north of the Lake, it would be well worth his while to avoid the very bad country in the neighbourhood of Dege la Mhora and the upper waters of the Kingani, and the still more miserable country of Kutu, which had been entirely ruined within the last two or three years by the Maviti. Considering the limited funds at their disposal, he thought the Committee had acted very wisely in selecting to begin with this route across the Rufiji to Nyassa, but at the same time the other routes were extremely interesting and important.

COLONEL GRANT said they must all deplore the fact that the funds were not sufficient to carry out expeditions along all the different routes; but he thought if a proper system were organised in all the great towns of England, Scotland, and Ireland, there would be no difficulty in obtaining the necessary amount. During the six months he had spent in the north of Scotland last year, having mentioned to friends there his wish to start an Exploration Fund Branch, he had not the slightest difficulty in raising 200*l.* in a few months, or one-tenth of the sum collected since the Fund was originated. It might be advisable to appoint a lecturer to go about the country in order to raise the required amount. As the Council knew, he had been opposed to the route to the north end of Nyassa, because he regarded the others as far better and more interesting; and also because he considered the Geographical Society should not join with a commercial body, but should take an independent course. The best route to explore would be from the Dana River, or from Brava, to the Victoria Nyanza. The different expeditions to Africa had, generally speaking, cost about 1*l.* 10*s.* per mile, and he believed he was committing no breach of confidence when he stated that Mr. Stanley's journey of 7000 miles across the continent was performed at about the same rate. He could not understand why so large a sum as 5000*l.* should be required for the northern route. He considered that that amount would be sufficient to open up the whole route from Zambesi straight north to Bangweolo, and thence, descending with the Congo waters, arrive at the

Aruwimi, which was supposed to be connected with the Uelle. He thought that the Society should really set to work to organise a proper committee to agitate the question of exploration, for he knew people, even in London, who had said, "What are you doing? We expected to be asked for money, but the subject seems to have dropped."

Sir RAWSON RAWSON asked Mr. Holmwood if he could give any positive information as to the disposition of the natives to the east of Victoria Nyanza, because one of the great discouragements to the exploration of that route was the reported difficulty of making way from Kilimanjaro, Mt. Kenia to the Lake, on account of the hostile character of the intervening tribes.

Mr. HOLMWOOD replied that he found throughout East Africa the pastoral tribes always fierce and treacherous, and the explorer, when passing through their country, must therefore be thoroughly well armed, even when most prepared to maintain friendly relations with them. In the route which Mr. Keith Johnston was about to follow, the tribes, where there were any inhabitants, were agricultural, and any man who knew the languages might pass along, as far as his personal safety was concerned, with only his carpet bag and an umbrella. To travel through the Masai, the Gallas, and the Somali countries, however, he must have an armed force, and negotiate for his passage from chief to chief. That was the reason why he fancied the expense of going by any of the northern routes would be so much greater, compared with the southern route through the agricultural tribes.

Mr. F. GALTON said however important it might be to secure M'tesa's co-operation, the quickest way of getting to him would not, he thought, be across the northern mountainous country, but from Zanzibar to Uganda by one of the routes that had already been travelled.

Mr. HOLMWOOD thought, on the contrary, that the quickest way would be to go from Mombasa, or near that port, *via* Chaga. He believed it would be found that there was a route right through the Masai country, which had been travelled by caravans for centuries. Nobody could say whether it would lead to Uganda or not, but he felt positive, from the information he had received from a great number of natives of different tribes, that it led to thickly populated countries on the east of Victoria Nyanza.

Colonel GRANT informed the Meeting that the Rev. Thos. Wakefield, a missionary at Mombasa, had proposed to him, in a letter received last year, to go from there *via* Kilimanjaro to the Lake, and return by the more southerly route. He did not say that there was any difficulty in it. Unfortunately, the Geographical Society had not been able to obtain the necessary permission from his superiors at home for such a journey.

Mr. KEITH JOHNSTON, on being called upon, stated that all the information he had been able to obtain represented the route from Mombasa to the Victoria Nyanza as passing through very wild tribes. Herr Hildebrandt was the last who had attempted exploration by that route, and he found it impossible to get beyond Ukambani, in consequence of the hostility of the natives about Mount Kenia. At the time of his visit all the caravans from Mombasa were stopped near Kilimanjaro. Dr. Kirk and Mr. Wakefield, however, did not consider the route an impracticable one; but its exploration seemed to require a larger sum than was at the disposal of the Committee. He wished to take this opportunity of assuring the Society that he appreciated the honour of being selected to lead an expedition too highly not to do his very utmost to carry it to a successful issue.

Admiral Sir ERASMUS OMMANNEY said he should like to hear a few remarks from African travellers with regard to the importance of tracing a route between the south extreme of Lake Tanganyika and the north end of Lake Nyassa.

General RIGBY said the difficulty which was supposed to exist in attempt-

ing to penetrate to Victoria Nyanza by the Mombasa and Bahringo routes was the hostility of the Masai tribes, who periodically came down and plundered all the more peaceable tribes, towards the coast, but there had never been an instance of those tribes attacking any white man. During his residence in Zanzibar the Masai invaded the settlement of Rabai, near Mombasa, where Mr. Rebmann had been located for many years. On their approach, Mr. Rebmann shut up the mission station and retired to Zanzibar. When he went back, eighteen months afterwards, to his great surprise he found that the Masai, who had plundered the whole country round, had not touched a single thing belonging to the English Mission. Now it would be very easy to open communications from the mission station near Mombasa with the Masai tribes. If they were once assured that no hostility was intended, and their friendship thus secured, it might be the means of opening up the country to Lake Bahringo and the northern end of Victoria Nyanza.

Sir H. RAWLINSON approved of the more moderate scheme adopted by the Committee, on the principle that it was better not to try to run before they could walk. The exploration of Africa must be gradual. If they had not sufficient funds to go in for the most important routes, those to the north, their best policy was to put up with the smaller undertaking to the south. They must cut their coat according to their cloth. They could not have a better officer for such an undertaking than Mr. Keith Johnston, who was a thoroughly practical traveller and geographer, and whose whole heart was in the work. No doubt, if the state of the funds permitted, they could suggest many important expeditions, not only in Eastern but in Central Africa. All that great area of country between the Congo and Lake Chad was as yet unknown. Some day he hoped to hear of an expedition leaving Nyangwe and going straight up to Darfur. They must, however, have the necessary means, and the only way to induce the English public to furnish those means was by showing that the Society was doing something. If Mr. Keith Johnston carried out the present as a preliminary expedition successfully (as doubtless he would), that would be a proof that something could be done, and the public would then, in all probability, open their purses and subscribe the funds for the more enlarged undertakings.

Sir HARRY VERNEY had been struck by Mr. Holmwood's statement that the tribes between the eastern coast and the northern end of Nyassa were agricultural, because he could quite understand that they were likely to be friendly, and not to oppose the passage of any expedition. He agreed that the way to obtain funds was to show the people of England and Scotland that they were doing something. He was one of those who felt disappointment that greater means had not been obtained, but he was not at all inclined to despair; for he believed if Mr. Keith Johnston's expedition was carried out, the country would have confidence in them and support them. He had listened with great interest to what Colonel Grant had told them about the route up the Zambesi to the central lakes. He had not heard that advocated before, but he had always felt that the important thing was to get communication between north and south, and the proposal to connect Nyassa with Tanganyika, and Colonel Gordon's explorations on the Nile seemed to be the best way of carrying out the work, which they were all anxious to see accomplished.

Mr. FREWEN said he had just returned from an expedition in Africa, though an unsuccessful one, on his own account. Everybody knew that African travel was more expensive than travel in any other part of the globe, and he thought success was to a great extent a question of funds. He thought much advantage might accrue if the proposed expedition could be joined with the Central African Telegraph arrangement. He did not quite know what sum

the Imperial Government had agreed to give to the Central African Telegraph Company as soon as they started; but at Cape Town he met Mr. Pender and Mr. Sebright, and had long conversations with them. They were very anxious for him to go up again from the north of the Transvaal to the Zambesi, Lake Nyassa, and Zanzibar. It appeared to him that the proposed Southern Expedition might be connected with the Telegraph Expedition, which had only to cover little more than 1300 miles from Pretoria to join Colonel Gordon's work on the Nile.

The CHAIRMAN said the first consideration was the choice of routes. The Committee were perfectly convinced of the reasonableness, to a great extent, of Colonel Grant's views, and the Mount Kenia and northern routes had much to recommend them, but they differed from him as to the danger and expense that would attend any attempt of that kind. It had really been on that ground that they had come to the conclusion that it was not desirable any longer to delay operations, and that the best mode of getting public support was to show that they were actively engaged in doing something with the means at their disposal. The fourth route which had been selected was entirely new ground. It was most essential that they should know whether a good road could be made from the northern end of Nyassa to the southern end of Tanganyika, and nothing that could be done in the northern lines exceeded it in practical utility and geographical interest. Sir Henry Rawlinson had rightly said that they must take their measures according to the degree of public support which was afforded. The proposed route was within their means, and, if the expedition was successful, would be productive of very excellent practical results, and would facilitate the opening of a line that would extend from north to south, connecting the great lakes. Colonel Grant thought if they exerted themselves more, and made a greater noise and more earnest efforts, funds could be obtained; but an organised system of entreaty and appeal would involve considerable expenditure, which the Committee did not feel disposed to enter upon. A few hundred pounds would easily slip away, and the Committee were very reluctant to adopt such a scheme. It seemed to them much more desirable that, with the funds at their disposal, they should go to work at once with such a competent explorer as they were satisfied they had in Mr. Keith Johnston, and send him out on a good practicable expedition. He would not enter into the question of what might have influenced a great portion of the public in not giving more ample funds. No doubt there were doubts in many minds as to how far all these explorations were really tending to benefit the natives; whether the measures necessary to be taken in order to prosecute any line of research did not involve conflicts with them; and whether in the end the results would be, in a commercial, political, or philanthropic sense, adequate to the sacrifices that must be made to attain them. The best way of overcoming this difficulty was to show by some practical work that scientific and practical objects could be carried out without necessarily involving great loss of life or conflicts with the natives. He believed if Mr. Keith Johnston's expedition proved a success there would be no want of funds to prosecute the exploration on a larger scale, and in any direction that might be thought best. In order to ascertain the opinion of the Meeting, he would propose, "That in the opinion of this Meeting the route recommended by the Exploration Committee is, under all the circumstances, the best to be adopted."

Sir H. RAWLINSON seconded the Resolution. The Society, he said, might reserve its geographical aspirations for great results until some future occasion. Let them commence in a practical, workmanlike way, and when Mr. Keith Johnston returned and told them more about the country, the public interest would be more excited, and ample funds would be obtained for carrying out larger undertakings.

Mr. MOCATTA begged permission to say a few words before the discussion closed. He had had some experience in raising funds, and considering the very general interest that was felt in the Society at the present moment, the intensely interesting nature of the Exploration, which he hoped and believed would be pregnant with results, and the fact that they had a gentleman like Mr. Keith Johnston ready to undertake it, he thought it would not be a very difficult thing before the end of July to raise a sum of 4000*l.* or 5000*l.* He yielded to the views of those gentlemen who were so much more capable than himself of forming a right opinion, but he believed among all classes of society there was so great an interest taken in the recent discoveries, which had shown that there were tens of millions of our fellow-creatures in a country which was formerly believed to be almost uninhabited, that the difficulty of raising 2000*l.* or 3000*l.* more would be an exceedingly minor one. He did not think more than 50*l.* need be spent in advertisements. Very little noise had been made about the Fund: 500*l.* might probably be collected in an ordinary drum, and 2000*l.* or 3000*l.* might be raised before the end of the season. They ought not to give up the idea of raising the required sum. If gentlemen and ladies were privately addressed on the subject by those who could command attention, no doubt they would subscribe their tens or hundreds.

The CHAIRMAN said no doubt money might be obtained in that way. He understood that Mr. Mocatta did not recommend the holding of public meetings, but simply a certain amount of advertisement and individual effort. He was quite sure the Council would be very glad to work in that direction, if they saw a fair prospect of getting an adequate return.

Colonel GRANT said he was delighted to hear from Mr. Frewen of the agitation that was going on in the Cape of Good Hope about an overland telegraph line which would connect the Cape with Europe. He had been informed that the chief engineer of the Telegraph Department at the Cape, who had lately delivered a very able lecture on the subject, was of opinion that it was perfectly feasible to erect an overland line to Tette, thence to the south end of Lake Nyassa, and then connect it with the East Coast, probably along the line which Mr. Keith Johnston would follow; Mr. Pender was in consultation with Mr. Sivewright about carrying out this land-scheme. Of course the safest route would always command the attention of the general public.

On the proposition of Sir HARRY VERNEY, seconded by Sir H. BARKLY, a cordial vote of thanks was accorded to the Chairman for the diligence and constant interest in the work he had shown, and for the Report which he had drawn up.

The CHAIRMAN, in thanking the Meeting for the vote they had been good enough to pass, said it would be worth Mr. Pender's while to give them a liberal contribution, for their work would certainly very much facilitate his. He hoped that those who were interested in the telegraph would see that there might be very valuable co-operation between them and those whose object was Geographical Exploration. In conclusion he read an extract from the '*Moniteur Belge*,' announcing that the African International Association had just received from Zanzibar a telegraphic despatch, saying that M. Cambier, of the Belgian Expedition, was at Saadani with the carriers; that MM. Wautier and Dutrieux would rejoin him on June 1st, and that they would proceed into the interior on the 7th of June. Their caravan was composed of 350 men, and all was going well. With so large a force, he conceived that there would be no difficulty in making their way in any direction they wished to go.

PRIZE MEDALS
OF THE
ROYAL GEOGRAPHICAL SOCIETY.

REPORT FOR 1878,
AND
PROGRAMME FOR 1879.

SYNOPSIS OF RESULTS

OF

PAST EXAMINATIONS.

Physical Geography.Political Geography.1869.—*Examiner*, A. R. WALLACE.*(Special Subject : Palestine.)***Gold Medal** W. GRUNDY.*(Rossall.)***Bronze Medal** G. W. GENT.*(Rossall.)**Honourably Mentioned* G. G. Butler, M. Stewart, A.
Wilson, G. B. Brown, E.
Thomas.*Examiner*, Rev. W. G.
CLARK.

H. C. RICHMOND.

(Liverpool College.)

J. D. WILDE.

*(Manchester Grammar School.)*E. Crabb, J. H. Collins, M.
L. Lewis, H. B. Dixon, D.
S. Bontflower.1870.—*Examiner*, A. R. WALLACE.*(Special Subject : India.)***Gold Medal** G. G. BUTLER.*(Liverpool College.)***Bronze Medal** M. STEWART.*(Rossall.)**Honourably Mentioned* W. Hind, G. Hughes, F. J.
Beckley, F. W. Hunt, R. F.
W. Shaw, E. C. Thomas.*Examiner*, Very Rev.
Dean HOWSON, D.D.

G. W. GENT.

(Rossall.)

J. H. COLLINS.

*(Liverpool College.)*E. Crabb, William Grundy,
George Hogben, J. D.
Murray, H. B. Dixon1871.—*Examiner*, Dr. W. B. CARPENTER, F.R.S.*(Special Subject : British North America.)***Gold Medal** D. McALISTER.*(Liverpool Institute.)***Bronze Medal** W. G. COLLINGWOOD.*(Liverpool College.)**Honourably Mentioned* R. A. Lundie, W. N. Shaw
W. C. Hudson, F. J.
Beckley, T. Disney, W. F.
Evill, H. R. F. Brown, W.
B. Ffooks.*Examiner*, C. H. PEARSON,
M.A.

G. HOGBEN.

(University School, Nottingham.)

R. N. ARKLE.

*(Liverpool College.)*F. M. Sparks, J. B. Heath,
D. S. Bontflower, A. Hassall.

Physical Geography.

- 1872.—*Examiner*, H. W. BATES, F.L.S.
(*Special Subject: South America.*)
- Gold Medal** S. E. SPRING-RICE.
(*Eton College.*)
- Bronze Medal** A. S. BUTLER.
(*Liverpool College.*)
- Honourably Mentioned* C. Penrose, E. Dickson, J. R. White, H. de V. Vane.

- 1873.—*Examiner*, Dr. J. D. HOOKER, F.R.S.
(*Special Subject: Eastern and Western Turkestan.*)
- Gold Medal** W. C. HUDSON.
(*Liverpool College.*)
- Bronze Medal** W. A. FORBES.
(*Winchester College.*)
- Honourably Mentioned* A. C. Cole, R. C. Reade, H. H. Hancock, H. Louis, N. M. Richardson, G. S. Pawle, G. R. Townsend, W. S. Widdicombe.

- 1874.—*Examiner*, Prof. A. C. RAMSAY, LL.D.
(*Special Subject: The British Isles.*)
- Gold Medal** L. WESTON.
(*City of London School.*)
- Bronze Medal** F. C. MONTAGUE.
(*University College School.*)
- Honourably Mentioned* H. M. Platnauer, W. S. Widdicombe, C. A. Spring-Rice, H. A. Miers, C. Healey, W. F. Wilson, A. R. Forsyth.

- 1875.—*Examiner*, General R. STRACHEY, R.E.
(*Special Subject: China.*)
- Gold Medal** H. A. MIERS.
(*Eton College.*)
- Bronze Medal** A. E. GARROD.
(*Marlborough College.*)
- Honourably Mentioned* C. A. Spring-Rice, H. Perrin, H. H. Hancock, W. D. Thomson, H. M. Platnauer.

- 1876.—*Examiner*, Prof. T. RUPERT JONES, F.R.S.
(*Special Subject: The Arctic Regions.*)
- Gold Medal** JNO. WILKIE.
(*Liverpool College.*)
- Bronze Medal** WALTER NEW.
(*Dulwich College.*)
- Honourably Mentioned* J. A. Robinson, L. P. Jacks, E. von Lengerke, Sir M. Clifton, F. S. Carey.

Political Geography.

- Examiner*, T. W. HINCHLIFF, M.A.
- W. G. COLLINGWOOD.
(*Liverpool College.*)
- W. C. GRAHAM.
(*Eton College.*)
- R. H. Sayle, W. L. Kingsford, H. E. Dixon.

- Examiner*, Maj.-Gen. Sir H. C. RAWLINSON, K.C.B.
- S. E. SPRING-RICE.
(*Eton College.*)
- A. T. NUTT.
(*University College School.*)
- A. Williams, W. L. Kingsford, G. H. Sing, S. H. B. Saunders, A. Hassall.

- Examiner*, Rev. Canon RAWLINSON, M.A.
- W. H. TURTON.
(*Clifton College.*)
- L. JACOB.
(*City of London School.*)
- J. F. Heyes, S. H. B. Saunders, R. W. Whiston, W. B. Styer.

- Examiner*, Sir RUTHERFORD ALCOCK, K.C.B.
- S. H. B. SAUNDERS.
(*Dulwich College.*)
- W. C. GRAHAM.
(*Eton College.*)
- J. Vans Agnew, W. M. H. Milner, J. F. Heyes, D. G. Crawford, T. Knox, A. S. Moriarty.

- Examiner*, Sir F. LEOPOLD MCCLINTOCK, F.R.S.
- THOMAS KNOX.
(*Bailebury College.*)
- W. M. H. MILNER.
(*Marlborough College.*)
- J. B. Johnston, H. W. Pigeon, J. F. Heyes, W. J. Newton, A. R. Ropes, C. W. MacMaster.

Physical Geography.Political Geography.1877.—*Examiner*, FRANCIS GALTON, M.A., F.R.S.*(Special Subject: Africa, South of the Equator.)***Gold Medal** WALTER NEW.
*(Dulwich College.)***Bronze Medal** ARTHUR SMYTH FLOWER,
*(Winchester College.)**Honourably Mentioned* John Chisman. J. A. Robinson,
Frank Stanton Carey.*Examiner*, SIR RAWSON W.
RAWSON, K.C.M.G., C.B.William John Newton.
*(Liverpool College.)*John Wilkie.
*(Liverpool College.)*Arthur Reed Ropes, William
Wallis Ord, Samuel Fowler
Blackwell, George Arnold
Tomkinson, Henry Colthurst
Godwin.1878.—*Examiner*, Colonel J. A. GRANT, C.B.,
C.S.I.*(Special Subject: The Basin of the Nile, and that
portion of Africa that lies to the East of it.)***Gold Medal** WM. JOHN NEWTON.
*(Liverpool College.)***Silver Medal** CHRISTOPHER MOUNSEY
WILSON.
*(Clifton College.)**Honourably Mentioned* Ernest George Harmer,
Miller Hancorne Clifford,
Francis Ashness Soppitt,
John Stapylton Grey
Pemberton.*Examiner*, CLEMENTS R.
MARKHAM, Esq., C.B.,
F.R.S.WM. WALLIS ORD.
*(Dulwich College.)*GEO. ARNOLD TOMKINSON.
*(Bailebury College.)*Arthur Reed Ropes, Arthur
Kay, David Bowie.

TABULAR SUMMARY OF AWARDS OF MEDALS ACCORDING TO SCHOOLS.

		Gold.		Bronze (1878 ET SEQ. SILVER).	
		Physical.	Political.	Physical.	Political.
	City of London	1874	.. .. .	.. .. .	1874
	Clifton .. .. .	.. .. .	1874	1878	.. .. .
	Dulwich	1877	1875, 1878	1876	.. .. .
	Eton	1872, 1875	1873	.. .. .	1872, 1875
	Haulcybury .. .. .	.. .. .	1876	.. .. .	1878
12	Liverpool College	1870, 1873, 1876, 1878	1869, 1872, 1877	1871, 1872	1870, 1871, 1877
1	Liverpool Institute	1871	.. .. .	.. .. .	.. .. .
1	Manchester School .. .. .	.. .. .	.. .. .	.. .. .	1869
2	Marlborough .. .. .	.. .. .	.. .. .	1875	1876
1	Nottingham .. .. .	.. .. .	1871	.. .. .	.. .. .
4	Rossall	1869	1870	1869, 1870	.. .. .
2	University College School .. .. .	.. .. .	.. .. .	1874	1873
2	Winchester .. .. .	.. .. .	.. .. .	1873, 1877	.. .. .
40 in ten years—13 Schools.					
	Liverpool College	12	Dulwich	2	Haulcybury
	Eton	5	City of London	2	Liverpool Institute
	Rossall	4	Marlborough	2	Manchester School
			Nottingham	1	

PRIZE MEDALS

OF THE

ROYAL GEOGRAPHICAL SOCIETY.

INSTITUTED, 1869.

RESULTS OF THE EXAMINATION FOR 1878.

List of Schools who were invited to compete in 1878.

English Schools.—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—The College, Malvern; Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; The School, Tonbridge; Uppingham School; Wellington College; Winchester College.

Channel Islands School.—Victoria College, Jersey.

Scotch Schools.—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School; Glasgow Academy.

Irish Schools.—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College; Rathmines School, Dublin.

Eleven of the above Schools furnished competitors, according to the following list, in which is entered the number of candidates in Political and Physical Geography from each school:—

	Physical.	Political.
Clifton College	2	3
Rossall School	0	2
Nottingham University School	1	0
Uppingham School	0	1
City of London School	2	1
University College School	3	0
Haileybury College	0	1
Liverpool College	4	0
Eton College	3	1
Dulwich College	2	2
Christ's Hospital School	1	0
Total ..	18	11

The Examiners appointed by the Council for 1878 were Colonel J. A. Grant, C.B., C.S.I., for Physical, and Clements R. Markham, Esq., C.B., F.R.S., for Political Geography. The examinations were held at the various schools, on the 25th of March, and the Prizes were presented at the Anniversary Meeting of the Society.

The special subject for the year 1878 was—

THE BASIN OF THE NILE, AND THE PORTION OF AFRICA THAT LIES TO THE EAST OF IT.

PHYSICAL GEOGRAPHY.

No. 1 EXAMINATION PAPER, 1878.

General.

[Candidates to answer TWELVE of the eighteen Questions.]

A. (Configuration of the Earth.)

(1.) Fill in the numbers in this question :—

		Square Miles.
Northern Hemisphere	{ Area of land	
	{ Area of water	
Southern Hemisphere	{ Area of land	
	{ Area of water	
Eastern Hemisphere	{ Area of land	
	{ Area of water	
Western Hemisphere	{ Area of land	
	{ Area of water	
Total area of Globe ..		

- (2.) What is the order of superiority of the four Continents, Europe, Asia, Africa, and America, regarding the configuration of their coasts as influencing commerce and civilisation? Give a sketch of each Continent.

B. (*General Physical Geography.*)

- (3.) Give the names, length, average breadth, and the general bearing of four of the principal Mountain-chains in the world. Also, the names, situations, areas, latitudes and general bearings of six of the largest fresh-water Lakes in the world.
- (4.) Describe the physical features in the course of the River Colorado; explain what is meant by the term "cañon."
- (5.) How is coral-rock formed? Give the extent and distance from the coast of the barrier reefs on the N.E. of Australia.
- (6.) What is the difference between a plain and a plateau? Mention examples. Give a section of the Himalayas at Mount Everest, with the countries north and south of them. (Four straight lines will suffice to show this; the longest line need not be above four inches; the altitudes to be marked upon the sloping lines.)
- (7.) In what county are the parallel roads of Glen Roy? Describe them, and the action which glaciers are supposed to have had in their formation.
- (8.) Suppose the temperature of our earth at the surface to be 50° Fahr., what may the temperature, as usually accepted, be at six thousand feet below the surface?
- (9.) In what county is the Giant's Causeway, and how has it been formed?
- (10.) Give the evidence we have that man existed with the extinct mammalia, and whether any such proof has been discovered in Britain.
- (11.) Where may the following terrestrial animals be found in their native state? If they be common to more than one continent, state the names of such:—Hippopotamus, zebra, gorilla, beaver, buffalo, antelope, deer, alligator, crocodile, humming-bird, turkey, peacock, guinea-fowl, lion, tiger, bear, sloth, kangaroo, elephant, rhinoceros.
- (12.) Give the geographical distribution of palms, conifers, and tree-ferns, and state where they are found in greatest abundance.
- (13.) What are Borax and Sulphur? where do they most abound, and to what uses are they applied?
- (14.) Suppose a line to be drawn across England at Cumberland, how many inches of rain fall annually near the extremities of the line on the east and on the west coast? and explain why there is such difference in the rainfall of the two positions.
- (15.) Give the temperature of the ocean at its surface and at its bottom, off Bermuda; and explain the cause of this great difference of temperature.
- (16.) Certain changes have influenced the rigour of climate, the courses of local winds, and the annual rainfall. Explain in each case how these changes have been brought about.
- (17.) What are Magnetism and Gravitation?
- (18.) In England how many degrees does the compass vary from the true north? Is this variation east or west, and has it always been the same?

No. 2 EXAMINATION PAPER, 1878.

Special.

[Candidates to answer EIGHT of the twelve Questions.]

- (1.) How is the Delta of the Nile formed? Give its extent, principal channels, nature of its deposit, and the rate of its accumulation. What is a Cataract? Describe the first cataract in the Nile Basin. Where does the fertile soil of Egypt come from? In what month does the Nile attain its height at Cairo? and when is it lowest? Give its expected rise in feet at Cairo.
 - (2.) Draw a section of the Valley of the Nile from Darfour to Lake Tzana or Dembea. Describe the route between Suakin and Berber.
 - (3.) Where does the River Atbara rise? Describe its banks, course, point of junction with the Nile, and say how much of it is navigable for boats.
 - (4.) Where is Khartoum situated? Give the reason for the difference of colour and the volume of water in the two rivers, White and Blue Niles. Name all the lakes in the Basin of the Nile, giving the area of each lake as far as is known.
 - (5.) Describe the geological features of the country traversed in 1868 by our Abyssinian army. What is basalt? and what is syenite?
 - (6.) Draw a map and give a description of the Nile and its banks between Gondokoro and the Albert Lake, and again between Albert Lake and Victoria Nyanza, noting all known altitudes. Do cataracts exist between Khartoum and Gondokoro?
 - (7.) What is the altitude and formation of Kilimanjaro? Describe the country between it and the East Coast. Name the rivers flowing into the sea on the east of the great Nile Basin and the principal sea-ports. Name the Nile tributaries in succession from Cairo to Victoria Nyanza, stating the latitudes of their confluences and whether they join on the right or left bank of the Nile.
 - (8.) In Schweinfurth's travels, in what country, or at what latitude and longitude did he quit the Basin of the Nile?
 - (9.) What are the characteristic land and water animals, birds, insects, and fish of the Nile Basin? What are the chief plants which obstruct the navigation of the Nile? Name two or more forests in the Nile Basin where there are indigenous trees suitable for boat-building or for canoes. Where may iron and copper, the product of the country, be obtained?
 - (10.) Name those tribes inhabiting the Nile Basin or the countries to the east of it who have woolly hair, and those others in the same regions who approach the Arab type.
 - (11.) Enumerate the chief animal, vegetable, and mineral products of economic value found in the Nile Basin.
 - (12.) What is a bar? Has the Nile, or any river to the east of its basin, a bar?
-

POLITICAL GEOGRAPHY.

NO. 1 EXAMINATION PAPER, 1878.

General.

[Candidates are required to answer not less than the specified number of Questions in each Group.]

Group A (THREE Questions must be answered).

- (1.) Explain in precise terms the meaning of Latitude and Longitude, and, in general terms, the methods of ascertaining each. State the difference between the Polar and Equatorial diameters of the earth.
- (2.) State approximately the latitude and longitude of Bordeaux, Madras, Sierra Leone, and Valparaiso. State the approximate distance, by the Cape Horn route, between Auckland (New Zealand) and Liverpool; also between Auckland and San Francisco. What land do vessels approach on a voyage from Liverpool to Melbourne by the Red Sea and Cape of Good Hope routes respectively?
- (3.) State the nearest approaches that have been made to the North and South Poles, giving the exact latitude in each case; by whom and when made.
- (4.) Through what islands does the Equator pass; and what are the principal towns which lie nearest to the Equator?

Group B (TWO Questions must be answered).

- (5.) Delineate the outline of the West Coast of America from Cape Mendocino to Panama, and name the principal ports situated upon that coast.
- (6.) Give the area and population of Spain and Portugal; also of Algeria and Tunis.
- (7.) State the names of the highest mountain peaks in Asia and South America, with their respective heights, and give the area of the Baltic Sea, including the Gulfs of Bothnia, Finland, and Riga; also of Lakes Superior, Ontario, and Titicaca, with the height of each of these three lakes above the sea.

Group C (TWO Questions must be answered).

- (8.) Describe generally the Political Boundaries of the different States of Europe in 1780, and in 1820; and the changes in the boundaries of European States which were made between 1820 and 1840.
- (9.) Describe the boundaries and extent of British India at the beginning of this century, and mention the acquisitions of territory that have been made since, with the dates of each.
- (10.) Give the names of the United States of North America at the time of the recognition of their Independence by Great Britain, and also the names of the States which have since been added to the Union; also of the Territories as now existing.

Group D (TWO Questions must be answered).

- (11.) By what route or routes was commercial intercourse maintained between

China and Western Asia in the middle ages? Also describe the different routes by which trade has been carried on between India and Europe in the 15th, 17th, and 19th centuries.

- (12.) Mention some of the lines by which it has been proposed to cut a ship-canal from the Pacific to the Atlantic.
- (13.) Enumerate the principal commercial ports in the Mediterranean and Adriatic, with the advantages offered by each as places of trade.

Group E (Two Questions must be answered).

- (14.) Describe the way in which human agency has affected the climatic conditions of any region of which you have read, the consequences of such alteration in the climate, and the permanent results—whether for good or evil.
- (15.) Enumerate the Colonies in Spanish America at the end of the last century, with their boundaries as regards each other, and the form of Government in each: and state which of these Colonies are now independent, giving their present names, boundaries, and form of Government, and which are still colonies.
- (16.) Give the name of any free port of which you have read, and state the nature of its trade, and the countries with which it has commercial transactions.

No. 2 EXAMINATION PAPER, 1878.

Special.

[Candidates are required to answer not less than the specified number of Questions in each Group.]

Group A (Two Questions must be answered).

- (1.) Give some account of the recognised forms of Government in the countries within the Nile Basin.
- (2.) Enumerate the different routes by which the Nile has been reached from the sea-coast between Suez and Zanzibar, and the uses that have been made of some of these routes, either for purposes of war or commerce.
- (3.) Name the provinces where salt, cattle, Venetian beads, cowrie shells, cloth, iron, copper, and silver, are used as circulating media.

Group B (Two Questions must be answered).

- (4.) Give an account of the routes by which the demand for slaves in Egypt has been supplied; naming the countries from which slaves have been brought.
- (5.) Explain the reasons why the Abyssinians have practically been excluded from free commercial intercourse with the outer world, and describe the nature of the country which intervenes between Abyssinia and the Red Sea on one side, and the Nile on the other.
- (6.) Give some account of the measures which have been taken, in recent years, to extend the sovereignty and influence of the Egyptian Government in the direction of the Lake Regions of the Nile.

Group C (*THREE Questions must be answered*).

- (7.) State the names of the principal travellers who have explored the course of the Nile and the tributaries flowing into it from the East, in chronological order, explaining the route taken by each: also name the tributaries from the East which are still unexplored.
- (8.) Give a general idea of the extent of country which is still unexplored to the south of Abyssinia, and between the Nile basin and the Indian Ocean.
- (9.) Enumerate the native races inhabiting Abyssinia, Nubia, and Egypt, giving the chief characteristics of each.
- (10.) Enumerate the native races in the region between Abyssinia and the Red Sea.
- (11.) What are the languages spoken in Abyssinia, and over what part of the country is each language spoken?

Group D (*THREE Questions must be answered*).

- (12.) What were the causes which led to the early formation of a civilized community in Egypt? Describe the climatic and other physical conditions in Abyssinia, stating whether they are conducive or detrimental to civilization.
- (13.) What is the nature of the obstructions which impede the use of the Nile as a fluvial highway, in the various parts of its course from the Albert Nyanza to the sea.
- (14.) Give a general description of the region drained by the Bahr-el-Ghazal and its tributaries, and name the travellers who have explored it.
- (15.) State, in general terms, the notions respecting the geography of the Nile Basin entertained by Ptolemy, by the Arab geographers, by the Portuguese in the fifteenth century, and by geographers after the return of Bruce in the last century.
- (16.) Upon a rough outline of the main features of the Nile Basin, show the areas occupied by the principal nations and tribes.

The following are the names of the successful competitors:—

PHYSICAL GEOGRAPHY.

			Age.		
Gold Medal	..	WILLIAM JOHN NEWTON	.. 17	..	<i>Liverpool College.</i>
Silver Medal	..	CHRISTOPHER MOUNSEY WILSON	18½	..	<i>Clifton College.</i>

Honourably Mentioned.

			Age.		
Jury	{	ERNEST GEORGE HARMER	.. .. 15½	..	<i>University College School.</i>
		MILLER HANCORNE CLIFFORD	.. .. 18	..	<i>Dulwich College.</i>
		FRANCIS ASHNESS SOPPITT	.. .. 18	..	<i>Dulwich College.</i>
		JNO. STAPYLTON GREY PEMBERTON	.. 17	..	<i>Eton College.</i>

POLITICAL GEOGRAPHY.

			Age.		
Gold Medal	..	WILLIAM WALLIS ORD	.. 18	..	<i>Dulwich College.</i>
Silver Medal	..	GEORGE ARNOLD TOMKINSON	18½	..	<i>Haileybury College.</i>

Honourably Mentioned.

			Age.		
ARTHUR REED ROPES	.. .. .	.. .. .	18½	..	<i>City of London School.</i>
ARTHUR KAY	.. .. .	.. .. .	16½	..	<i>Rossall School.</i>
DAVID BOWIE	.. .. .	.. .. .	15	..	<i>Dulwich College.</i>

REPORTS OF THE EXAMINERS FOR 1878.

I.—PHYSICAL GEOGRAPHY.

To the Council of the Royal Geographical Society.

GENTLEMEN,

19, UPPER GROSVENOR STREET, LONDON,
April 11th, 1878.

I HAVE the honour to report that the award of the Medals for the greatest proficiency in Physical Geography in the Examination of this year is as follows:—

Gold Medal WILLIAM JOHN NEWTON, Liverpool College.
Silver Medal CHRISTOPHER MOUNSEY WILSON, Clifton College.

Honourably Mentioned.

- Equal. { ERNEST GEORGE HARMER, University College School.
 { MILLER HANCORNE CLIFFORD, Dulwich College.
3. FRANCIS ASHNESS SOPPITT, Dulwich College.
4. JOHN STAPYLTON GREY PEMBERTON, Eton College.

After these came the names of Bowman, Hartog, Ackerley, and Robinson, whose replies were all above the average.

Replies were given more or less to all the questions; but the best replies were, without exception, those upon General Geography, on such subjects as the Cañons of Colorado, the Giant's Causeway, Coral-rock, Extinct Mammalia, Borax and Sulphur, Distribution of Palms, Conifers, and Tree-ferns, the questions on which were answered, I might say brilliantly, by most of the candidates above mentioned.

Those questions which were worst answered were upon the Special subject of the Nile Basin, and upon the area of land and water on our globe, on the principal mountains and lakes of the world, and on terrestrial animals in their native state, showing that these subjects had not been sufficiently prepared.

Question 1, on the proportion of land and water in the two hemispheres, was replied to by only one-half of the eighteen

candidates, and the general average of these replies was below par; varying in error from one hundred millions to ninety millions of square miles.

Question 3, on the principal mountain-chains and fresh-water lakes, was answered incorrectly as to the dimensions, latitudes, and altitudes; also there were many omissions and mistakes, such as making the Caspian a fresh-water sea, which shows that the subject had not been prepared.

Although the average of the replies to Question 11, on the distribution of wild animals, was above par, some replies showed a great amount of ignorance on the subject, as the following instances serve to show:—bears were from Africa; white elephant, Ceylon; turkey from Asia; tiger from Africa; hippopotamus from India; zebra from America; humming-bird from Africa; gorilla from Australia and South America; guinea-fowl from Europe and America: but it is worthy of mention that, though none of the candidates answered this question with complete accuracy, yet the replies of those whose names are mentioned in this Report were above the average.

The questions most numerous answered were 2, 5, 11, and 17 in General Geography, and 1, 3, 4, and 7 in Special Geography, but only in one instance were they the best replied to; whereas the questions which had the fewest replies (1, 4, 7, 13, and 16 in General, and 2, 6, and 8 in Special Geography) were the most correctly answered.

Few candidates attempted to draw sketches of Europe, Asia, Africa, and America; and those who did, gave generally poor results. Sections and sketches, taken as a whole, were very indifferent.

Six candidates answered more questions than were required of them by the rules: I therefore struck out, and made no allowance whatever for, any questions above twelve in General, and eight in Special Geography.

Taking the Examination altogether, the replies of fourteen of the eighteen candidates are above the average; but, whatever be the cause, this year there is a considerable falling off in the average number of schools and candidates competing for the Medals in Physical Geography.

J. A. GRANT.

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II.—POLITICAL GEOGRAPHY.

To the Council of the Royal Geographical Society.

THERE were eleven competitors in the Political Geography Examination for 1878. The examination consisted of 32 questions, divided equally in two papers—one general, and the other having special reference to the Nile Basin. The following are the successful competitors:—

Gold Medal WILLIAM WALLIS ORD, Dulwich College.

Silver Medal GEORGE ARNOLD TOMKINSON, Haileybury College.

Honourably Mentioned.

ARTHUR REED ROPES, City of London School.

ARTHUR KAY, Rossall School.

DAVID BOWIE, Dulwich College.

All the competitors show weakness in Historical and Comparative Geography. Only one (David Bowie) could give the thirteen original States in the American Union, and none could describe the political divisions of Europe at a given period with any approach to accuracy or precision. But, on the other hand, they have all been well grounded in the elements of Mathematical Geography; and several gave evidence of more than a mere knowledge derived from text-books, their answers indicating that they have thought over questions in Physical and Political Geography with intelligent interest. I am inclined to recommend that the Physical and Political Geography, in these Examinations, should not cover exactly the same ground. I think a more useful result would be obtained, if the latter had special reference to some selected period, such as the age of the Crusades or the age of American discoveries. This plan would tend to secure more attention being given to the acquirement of sound and accurate knowledge in a branch of the subject which is most useful to the generality of educated people, namely, Comparative Political Geography.

CLEMENTS R. MARKHAM.

PROGRAMME FOR 1879.

THE Council of the Society have satisfaction in repeating the offer of Prize Medals for the ensuing year; the Second Medal to be Silver, instead of Bronze as heretofore. They have invited the following Public Schools to take part in the competition:—

List of Schools invited to compete in 1879.

English Schools.—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Bristol Grammar School; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—The College, Malvern; Manchester School; Marlborough College; University School, Nottingham; High School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; The School, Tonbridge; Uppingham School; Wellington College; Winchester College.

Channel Islands School.—Victoria College, Jersey.

Scotch Schools.—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School; Glasgow Academy.

Irish Schools.—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College; Rathmines School, Dublin.

Syllabus of Examinations for the Prize Medals of the ROYAL GEOGRAPHICAL SOCIETY in 1879.

EXAMINATION IN PHYSICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, according to printed regulations (which will be forwarded in due time), on the third Monday in March 1879, and

will consist of two papers of three hours each; the one to be answered between 9 and 12, $9\frac{1}{2}$ and $12\frac{1}{2}$, or 10 and 1 A.M. (according to the convenience of the School); and the other between 2 and 5, $2\frac{1}{2}$ and $5\frac{1}{2}$, or 3 and 6 P.M.

N.B. It is necessary, in order that Candidates may be admitted to the Examination, that their names be sent in to the Secretary of the Society on or before the *first* Monday in March.

A Medallist may not again compete for the same Medal.

No. 1 Examination Paper will consist of questions on the following subjects:—

A. *Configuration of the Earth*, as learnt by careful study of a globe. What are the distances, speaking roughly, between such remote places as may be specified? What places of importance lie on the direct lines between them, and what is the section along each? What are the relative size, elevation, &c., speaking roughly, of such well-known districts, mountains, and rivers, as may be specified?

B. *General Physical Geography*.—Distribution of land and sea, forests, plateaux, glaciers, volcanoes, man, animals, plants and minerals; climates and seasons; oceanic, meteorological and magnetic phenomena.

* * Extra marks will be allowed for sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy. Some of the questions will be framed so as to make illustrations by sketches obligatory.

The candidates may be required to construct a rough map without the aid of special instruments, from a brief description of a district illustrated by itineraries and bearings.

No. 2 Examination Paper will consist wholly of questions on a special subject.

The special subject appointed for 1879 is—

THE BARBARY STATES, AND THE SAHARA.

EXAMINATION IN POLITICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, at the same hours and under precisely the same regulations as those in Physical Geography.

No. 1 Examination Paper will consist of questions on the following subjects :—

A. *Descriptive Geography*.—Explanation of latitude and longitude. What are the distances in geographical miles, speaking roughly, and as learnt by the careful study of a globe, between such remote places as may be specified? What places of importance lie on the direct line between them? What is the relative size, speaking roughly, of such well-known countries, mountains, and rivers, as may be specified?

B. *Historical Geography*.—Embracing (1) the boundaries of states and empires at different historical periods; (2) the chief lines of commerce, ancient and modern; (3) the influence of geographical features and conditions upon the distribution of races and political history of mankind.

* * Extra marks will be allowed for maps and sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. The use of blue and red pencils is permitted for this purpose. No marks will be given for neatness of execution, apart from accuracy. Some of the questions will be framed so as to make illustrations by sketches obligatory.

The candidates may be required to construct a rough map without the aid of special instruments, from a brief description of a district illustrated by itineraries and bearings.

No. 2 Examination Paper will consist wholly of questions on a special subject.

The special subject appointed for 1879 is—

THE BARBARY STATES, AND THE SAHARA.

Candidates will be expected to be acquainted with the History of Geographical Discovery in Northern Africa.

The following books contain much information regarding the Physical and Historical Geography of the Barbary States, and the Sahara. Candidates, however, are not required to be specially acquainted with any one of the works included in this list, which has been compiled mainly for the purpose of aiding the gradual formation, at a moderate cost, of geographical libraries, suitable for Public Schools :—

‘Stanford’s Compendium of Geography—Africa.’ By Keith Johnston.

Barth, ‘Travels and Discoveries in North and Central Africa.’ 5 vols. 1857.

Gibbon’s ‘History of the Decline and Fall of the Roman Empire.’ Chapter 51. Containing the conquest of Africa by the Saracens.

Smith’s ‘Dictionary of Greek and Roman Geography’ (Murray, 1856). Containing articles on the chief Greek and Phœnician colonies in North Africa.

Heeren’s ‘Historical Researches into the Politics, Intercourse, and Trade of the principal nations of Antiquity. African nations.’ 2 vols.

Sir Grenville Temple’s ‘Excursions in the Mediterranean, Algiers, and Tunis.’ 2 vols.

Blakesley’s ‘Four Months in Algeria, with a Visit to Carthage.’

Shaw’s ‘Travels, relating to several parts of Barbary,’ &c. 1757.

Denham and Clapperton’s ‘Narrative of Travels in Northern and Central Africa. 1826.

Tristram, ‘The Great Sahara.’ 1860.

Bosworth Smith, ‘Carthage and the Carthaginians.’

Nachtigal’s ‘Journey to Lake Chad and the Neighbouring Regions.’ ‘Journal, R.G.S.,’ vol. xlv. p. 396.

Playfair, ‘Travels in the Footsteps of Bruce.’ Kegan, Paul and Co. 1877.

Rac, ‘The Country of the Moors.’ Murray, 1877.

Hooker, Sir J. D., and J. Ball, ‘Journey to Morocco and Ascent of the Atlas’ (in course of publication).

Leared, ‘Morocco and the Moors.’ Sampson Low & Co., 1876.

Rohlf’s, ‘Adventures in Morocco.’ 1874.

Richardson, ‘Travels in the great Desert of Sahara.’ Bentley, 1848. 2 vols.

Murray’s ‘Handbook for Algeria.’ 1874.

* * * In accordance with a recent Minute of the Council, the Libraries of competing Schools can be furnished with the Volumes of the Society’s ‘Journal’ at the rate of 15s. each for past, and 7s. 6d. for the present and future years.

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